NUCLEAR SCIENCE ABSTRACTS
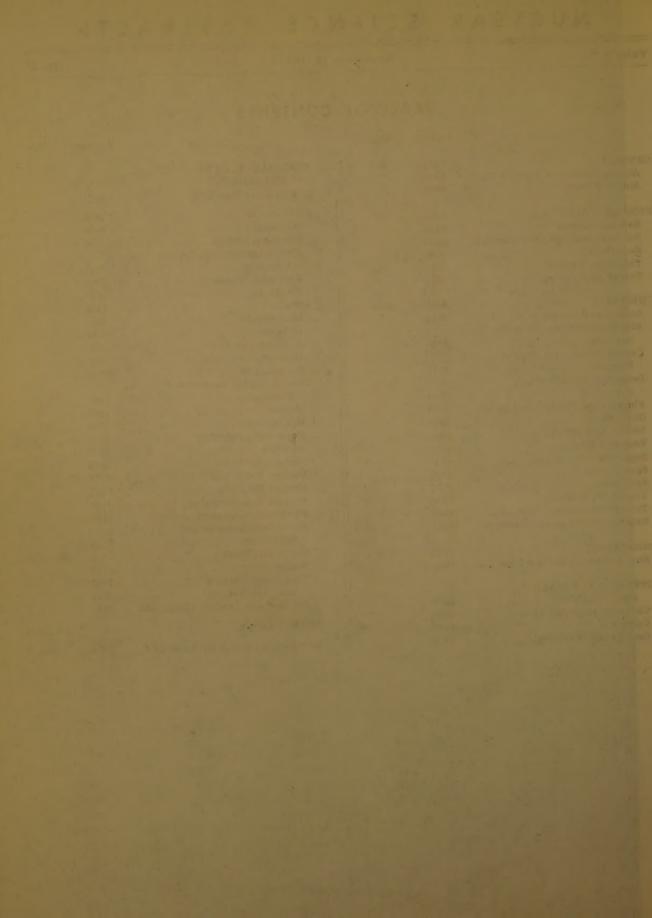
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GENERAL

ATOMIC BOMBS AND WARFARE

6817 AECD-3643
General Services Administration, Washington, D. C.
THE EFFECT OF ATOMIC WEAPONS ON GLAZING AND
WINDOW CONSTRUCTION. ANNEX 3.5 [OF] SCIENTIFIC
DIRECTOR'S REPORT OF ATOMIC WEAPON TESTS AT
ENIWETOK, 1951. OPERATION GREENHOUSE. Walton C.
Clark. Aug. 1951. Decl. with deletions Dec. 28, 1954. 84p.

Various types of commercial windows glazed with
plastic and different kinds of glass were installed on four
sides of a test structure, which was exposed to the blast of
an atomic weapon. The photographic record and detailed
description of the windows before and after the blast are
presented. An evaluation was also made of the comparative
protection against flying glass afforded by Venetian blinds,
insect screens, and mesh wire netting on the inside of
window openings. (C.H.)

6818
RADIOACTIVE FALLOUT FROM BOMB CLOUDS. Howard
L. Andrews (National Cancer Inst., Bethesda, Md.). Science
122, 453-6(1955) Sept. 9.

The mechanisms involved in the production of fall-out
particles and factors affecting the distribution of fall-out
following the explosion of nuclear weapons are reviewed.
The biological hazards associated with fall-out are dis-
cussed. (C.H.)

ATOMIC POWER

6819
REPORT FROM GENEVA. ADMINISTRATION. Nucleonics
13, No. 9, 34-9(1955) Sept.

Information on nuclear power presented at the Geneva
conference is summarized. The future need for nuclear
power and factors influencing this need, the capital outlay
required for nuclear power plants, and the regulations to
protect health that should be set up are discussed. Data are
presented on world energy production and requirements,
the present and future energy requirements of some coun-
tries, the cost per kw capacity of conventional and nuclear
power plants, component investment costs for nuclear
plants, and operating costs for various reactors. Several
reactor-radiation exposure cases are described. (M.P.G.)

BIOLOGY AND MEDICINE

6820 ANL-5456
Argonne National Lab., Lemont, Ill.
REPORT ON BIOLOGICAL, MEDICAL AND BIOPHYSICS
PROGRAMS. Part I. QUARTERLY REPORT OF BIO-
LOGICAL AND MEDICAL RESEARCH DIVISION FOR
APRIL, MAY, JUNE 1955. Part II. SEMIANNUAL RE-
PORT OF RADIOLOGICAL PHYSICS DIVISION FOR

JANUARY THROUGH JUNE 1955. July 1955. 147p. Con-
tract W-31-109-Eng-38.

Biological and Medical Research Division. Progress is
reported on the following studies: the effects of exposure
to x radiation on plasma amino acids in chick embryos;
the effects of temperature on the radiosensitivity of frogs;
the regeneration and recovery of the spleen and thymus
after single doses of x irradiation; the effects of irradiation
on tissue ascorbic acid levels; oxidative phosphorylation in
mitochondria of brains of bats exposed to massive x ir-
radiation; the pathological effects of continuous gamma ir-
radiation on mice; the toxicity of Sr^{90} and Ca^{45} in mice;
determinations on the circulating blood volume of adult
roosters and 3- to 5-day-old chicks; the effect of muco-
polysaccharide on the stability and structure of collagen;
enzymatic factors affecting the mutation rate of E. coli;
the biosynthesis of methionine by A. aerogenes; reaction
mechanisms of amino acids; studies on protein bio-
synthesis using C^{14}-labeled lysine as a tracer; the toxicity
of Ru^{106} for mice; the effects of tissue homogenates on
radiosensitivity of amoeba; and development of a method
for the separation of trace amounts of Be from bulk
cationic mixtures, based on the affinity of salicylate
analogs for Be. Radiological Physics Division. Modifica-
tions are described in instruments for the detection and
measurement of neutrons and γ radiation. The natural body
Ra content and rate of intake of Ra were measured for boys
16 to 18 years old, and results are compared with those
previously obtained on adults. The performance of a
scintillation detector for the counting of α particles from
Rn and its radioactive daughters is described. Data are
reported from a study of the movement of water in soil.
Equipment for the scintillation measurement of the γ
activity of the human body is described, and data are pre-
sented from measurements of background, Ra, and K^{40}
body content. The absorption and scattering of B particles
in gases and drift velocity of electrons in gases are dis-
cussed. Apparatus is described for the measurement of
positive ion emission from potassium-sensitized platinum.
Meterology studies engaged in during the period are sum-
marized. (For preceding period see ANL-5426.) (C.H.)

6821 NP-5741
Battelle Memorial Inst., Columbus, Ohio.
STERILIZATION OF FOODS BY SOFT X-RAYS. Radcliffe
F. Robinson, Robert C. McMaster, and Jules H. Cahn.
Oct. 15, 1953. 13p.

The effectiveness, building costs, space requirements,
versatility, and equipment costs of the application of soft
x rays to food sterilization are discussed. (D.E.B.)

6822
STUDY OF TUMOR CELL PROPULATIONS BY MONTE
CARLO METHODS. Joseph G. Hoffman, Nicholas Metropolis,
and Verna Gardiner (Los Alamos Scientific Lab., N. Mex.).
Science 122, 465-6(1955) Sept. 9.

6823
FEULGEN STAINING OF CELL SUSPENSIONS. C. C.

Bowen (Iowa State Coll., Ames). Stain Technol. 30, 135-8 (1955) May.

A method is described which yields permanent Feulgen preparations of meiotic material from Lilium anthers, eliminating difficulties heretofore encountered. Cells are handled as a suspension through the staining and fixing procedure, and centrifugation and decantation of the supernatant permits changing reagents. Several technics are given which minimize the optical problems created by the heavily sculptured walls of pollen grains, and some applications are suggested. (auth)

RADIATION EFFECTS

6824   AMRL-198
Army Medical Research Lab., Fort Knox, Ky.
A LABORATORY TEST FOR DIAGNOSIS OF LETHAL EXPOSURE TO IONIZING RADIATION IN RATS. J. B. Storer and H. C. Simonson. July 22, 1955. 14p. Project No. 6-59-08-014.

By determining blood plasma levels of trace amounts of radioiodine in rats 24 hr after injection and 72 hr after x-irradiation with 0 to 900 r, it was possible to divide the animals into sublethal and lethal exposure groups with an accuracy of approximately 83 to 95% depending on whether a false diagnosis of lethal exposure is acceptable. At doses in excess of 900 r there appeared to be a reversal of the effect on I^{131} levels which might prove of value in the diagnosis of supralethal exposure. (auth)

6825   NM-006-012.04.86
Naval Medical Research Inst., Bethesda, Md. and Naval Radiological Defense Lab., San Francisco.
THE RELATIVE BIOLOGICAL EFFECTIVENESS OF ATOMIC BOMB GAMMA RADIATION IN MICE. E. P. Cronkite, V. P. Bond, R. H. Lee, and W. H. Chapman. May 25, 1955. 24p.

The lethal effects of atomic bomb nuclear γ radiation as a function of distance from the weapon and as a function of measured dose was determined using mice as the test object. Data are compared with laboratory data on the effects of x radiation. (C.H.)

6826   NP-5758
Chicago. Univ. Air Force Radiation Lab.
PHARMACOLOGICAL ACTION OF ANESTHETIC AGENTS IN IRRADIATED ANIMALS. (School of Aviation Medicine, Project No. 21-3501-0005, Report No. 20). James E. Wilson. July 1955. 8p.

The administration of the common anesthetic agents (cyclopropane, ethylene, nitrous oxide, ether, and thiopental sodium) at various periods after x ray produced no significant changes in the thirty-day mortality of x-irradiated rats. However, a lowered tolerance toward cyclopropane was observed as evidenced by a significant increase in the number of anesthetic deaths when it was given in mid-lethal quantities seven days after x ray. No significant lowering of tolerance toward anesthetic agents was observed when either ether or thiopental sodium were given at two hours and seven days after x ray. When ethylene was administered two hours after x ray, the increase in the survival times of the anesthetized rats was statistically significant as compared with that of the un-anesthetized controls. (auth)

6827

EFFECT OF IONIZING RADIATION ON HAEMOGLOBIN

AND CYTOCHROME. C. H. Laser (Univ. of Cambridge, England). Nature 176, 361-2(1955) Aug. 20.

6828
STUDIES ON NAGASAKI (JAPAN) CHILDREN EXPOSED IN UTERO TO THE ATOMIC BOMB. A ROENTGENOGRAPHIC SURVEY OF THE SKELETAL SYSTEM. Wataru W. Sutow and Emory West (Atomic Bomb Casualty Commission). Am. J. Roentgenol. Radium Therapy Nuclear Med. 74, 493-9(1955) Sept.

A roentgenographic survey of the skeletal system was made on 74 children who were exposed in utero to the atomic bomb explosion in Nagasaki, Japan at distances under 2,000 meters from the hypocenter. The findings were compared with those on a group of 91 children also exposed while in utero to the bomb but at distances of 4,000 to 5,000 meters. No differences in the incidence of skeletal abnormalities were found between the two groups. (auth)

6829
ON THE CONTENT OF SULPHYDRYL GROUPS IN NORMAL MOUSE TISSUES AND FOLLOWING WHOLE-BODY EXPOSURE TO X RAYS IN LETHAL DOSES. E. Ya. Graevskii and L. I. Korchak (Severtsov Inst. of Animal Morphology). Doklady Akad. Nauk S.S.S.R. 102, 939-41(1955) June 11. (In Russian)

6830
ON THE SENSITIVITY OF PLANTS (OATS) TO THE EFFECTS OF RADIOPHOSPHORUS IN VARIOUS GROWTH PHASES. A. G. Shestakov, G. F. Ivanova, and N. I. Shmel'kova (Moscow Agricultural Academy). Doklady Akad. Nauk S.S.S.R. 102, 1043-6(1955) June 11. (In Russian)

6831
SOME NUTRITIONAL ASPECTS OF BACTERIAL RECOVERY FROM IONIZING RADIATION. G. E. Stapleton, Anthony J. Sbarra, and Alexander Hollaender (Oak Ridge National Lab., Tenn.). J. Bacteriol. 70, 7-14(1955) July.

The B/r strain of E. coli, grown on a complete medium such as nutrient broth, showed radiation-induced requirements for nutritional factors. Some evidence has been presented which indicates that the bacteria showing the nutritional requirements are not stable auxotrophic mutants. Extracts of natural materials will supply the nutritional requirements. A chemically defined medium has been developed which will substitute for natural materials in bringing about recovery. The type of media used to culture cells prior to irradiation determines to a great extent the sensitivity of the cell to ionizing radiation as well as the response of cells to added factors in the plating media after irradiation. The data accumulated to date suggest that the recovery process investigated is related to the synthesis of new enzymes in the irradiated cell. (auth)

6832
THE EFFECT OF TEMPERATURE ON X-RAY INDUCED MUTABILITY IN ESCHERICHIA COLI. E. H. Anderson and D. Billen (Oak Ridge National Lab., Tenn.) J. Bacteriol. 70, 35-43(1955) July.

The effects of several temperatures of incubation on the induction of mutations following x-ray exposure have been investigated. It was found that the induction of mutations (absolute number of mutants) in several E. coli auxotrophs was always maximal, as compared to incubation at other temperatures, when the plated cells were incubated at 18 to 24°C for 48 hrs. The effects of similar temperature treatment on survival were strain specific. The data suggest that at least a portion of x-ray-induced death is not the

result of the induction of lethal mutants. The plating medium had a decisive influence on the number of cells surviving x-ray exposure, survival being greater on nutrient agar than on a synthetic minimal media. For this reason it seemed necessary to obtain all survival data from cells plated on the same medium (plus required nutrient) as that used to determine the number of mutants. The number of residual divisions of survivors of an exposed suspension plated on supplemented minimal medium was similar when the plated cells were incubated at 24 or 37°C. There seemed to be essentially no influence of an added suspension of radiation-sterilized cells on mutagenesis of unirradiated cells. Thus the reported release of cellular constituents by x-irradiated cells appears to exert little influence on the mutation rates observed in irradiated suspensions of E. coli. (auth)

6833

FUNDAMENTALS OF RADIOBIOLOGY. Z. M. Bacq and Peter Alexander. New York, Academic Press Inc., Publishers, 1955. 389p.

6834

RADIOACTIVE PHOSPHORUS IN THE DIAGNOSIS OF SKIN TUMORS. DIFFERENTIATION OF NEVI, MALIGNANT MELANOMAS, AND OTHER SKIN TUMORS. Franz K. Bauer and Charles G. Steffen. J. Am. Med. Assoc. 158, 563-5(1955) June 18.

When radioactive phosphorus (P^{32}), in doses of from 100 to 150 μc, was injected intravenously into patients with a variety of skin tumors and the lesions counted with a Geiger-Mueller tube three hours later, it was found that in superficial lesions significant differences in counts could be obtained. Malignant melanomas can be differentiated from benign nevi by significantly increased concentrations of P^{32}. Basal cell carcinomas and squamous cell carcinomas cannot be differentiated from benign skin lesions with any degree of accuracy by the procedure described. (auth)

6835

THE RELATION OF THYROIDAL ACTIVITY AND RADIATION TO GROWTH OF HYPOPHYSEAL TUMORS. Abraham Edelmann (Brookhaven National Lab., Upton, N. Y.). pp.250-5 of "The Thyroid—Report of Symposium held June 9 to 11, 1954—Brookhaven Symposia in Biology No. 7". Washington, Office of Technical Services, Feb. 1955. 271p. $1.75.

The work on the factors concerned with the development of the pituitary tumors originally found after administration of large amounts of I^{131} to the mouse is briefly reviewed. Data are presented to show that in radiothyroidectomized mice x-irradiation of either the head or body or the administration of Na^{24} will produce the tumors. Castration followed by whole body x-irradiation will produce a basophile adenoma in mice. (auth)

6836

TOTAL-HEAD(BRAIN) X IRRADIATION OF MICE AND PRIMARY FACTORS INVOLVED. Herman C. Mason (Illinois State Psychopathic Inst.), Beryl T. Mason, and Walter S. Moos (Univ. of Illinois Coll. of Medicine). Brit. J. Radiol. 28, 495-507(1955) Sept.

White Swiss (CFW) mice, male and female, were exposed at 30 days of age to total-head x irradiation given in a single dose in order to determine the $LD_{50/30}$. The levels of exposure ranged from 500 to 4000 r (22 Mev) betatron, and from 500 to 3500 r (200 kvp) x-ray irradiation. The mouse $LD_{50/30}$ for total-head betatron x irradiation was found to be 1600 to 1650 r. The $LD_{50/30}$ for total-head 200 kvp x irradiation was found to be 1250 r. There appears a difference in

the lethal responses of approximately 30-day-old mice to the two types of radiation. Betatron irradiation is only about 75 to 78% as effective as 200 kvp x irradiation to the whole head. The findings, in general, indicate that when Swiss mice are exposed to total-head irradiation the degree of injury appears to be a function of the dose. (auth)

6837

A TECHNIQUE OF MEASUREMENT, AND THE EFFECT OF X-RAY ON THE LEAKAGE OF PAH OUT OF THE RABBIT KIDNEY SLICE. Mortimer L. Mendelsohn (Walter Reed Army Medical Center, Washington, D. C.). Am. J. Physiol. 182, 119-23(1955) July.

A method has been devised for estimating the leakage of PAH (para-aminohippuric acid) out of the rabbit kidney cortex slice preparation, by determining the rate of loss of a PAH concentration difference after chemical inhibition of the transport mechanism. Control values for the leak constant are given, using three dissimilar inhibitors—carinamide, $HgCl_2$ and DNP. After 150,000 r x irradiation, the leakage of the slices did not change, indicating that the known x-ray effect on concentration ratio was due to interference with active transport. Estimations are also made of the transport rate of the slices. An hypothesis of in vivo PAH transfer as an exponential process is suggested, and is developed into a form that permits comparison to the slice. The kidney slices at 25°C had about 10% the transport rate of the intact rabbit kidney at body temperature. (auth)

6838

REPARATION OF THE FETAL EYE FOLLOWING RADIATION INSULT. Roberts Rugh and Joan Wolff (Columbia Univ., New York). Arch. Ophthalmol. 54, 351-9(1955) Sept.

Fetal CF_1 mice were exposed on gestation day 12.5 to x rays in doses ranging from 50 to 300 r, and the eyes were examined at 4, 24, and 72 hours and at 6 days and 6 weeks thereafter to determine the cytological changes caused by the irradiation. Data are summarized. (auth)

6839

EXPERIMENTAL OCULAR EFFECTS OF HIGH-VOLTAGE RADIATION FROM THE BETATRON. Albert C. Biegel. Arch. Ophthalmol. 54, 392-406(1955) Sept.

A study of the clinical and histologic effects of irradiating the rabbit eye with 16 to 19-Mev electrons and 23-Mev x rays by means of the betatron for a wide dosage range is described. (auth)

6840

THE EFFECTS OF DOSE RATE VARIATION OF FISSION NEUTRONS AND OF Co^{60} γ-RAYS ON SURVIVAL IN YOUNG CHICKS. Howard H. Vogel, Jr. and S. Phyllis Stearner (Argonne National Lab., Lemont, Ill.). Radiation Research 2, 513-22(1955) Aug.

Three-day-old white leghorn chicks were irradiated with fast neutrons at dose rates of 1 rep/min and 4 rep/min and with Co^{60} γ rays at dose rates of 6 r/min, 12 r/min, and 22 r/min. Chicks exposed at the lower dose rates showed a marked increase in survival. Twenty-one-day mortality curves are presented for each dose rate. Early (48-hr) mortality was evident after exposure to the higher dose rates of both types of radiation but was insignificant after exposure to the lower dose rates. The relative biological effectiveness of fast neutrons and Co^{60} γ rays for producing 21-day lethality in the chick was found to be 3.72 when the high dose rate survival curves were compared. (M.P.G.)

6841

THE RESPONSE OF HYPOPHYSECTOMIZED RATS TO X-

RADIATION AND REPLACEMENT THERAPY. E. A.
Sellers and John C. Barlow (Univ. of Toronto, Canada).
Radiation Research 2, 534-7(1955) Aug.

The results of experiments are reported on the resistance
to x radiation of rats whose pituitary glands had been re-
moved. It was found that hypophysectomy reduced the
resistance of rats to x irradiation of the whole body. Of the
various materials given to hypophysectomized rats after ir-
radiation (ACTH, growth hormone, insulin, thyroxine,
cortisone, testosterone), only thyroxine increased the per-
centage survival. Hypophysectomized irradiated animals
which received insulin died sooner than hypophysectomized
irradiated controls. (M.P.G.)

6842

THE REACTION OF THE SKIN EPITHELIUM OF THE TAILS
OF RANA CATESBIANA TADPOLES TO LOCAL X-
IRRADIATION. V. V. Brunst (Roswell Park Memorial Inst.,
Buffalo, N. Y.). Radiation Research 2, 556-67(1955) Aug.

One hundred tadpoles of Rana catesbiana were divided into
2 groups. In the first group, the tails were amputated and
irradiation with 2000 to 4000 r was made after formation of
tail regenerates. In the second group, the tails were ir-
radiated with the same doses without amputation. The
observed results are described and illustrated. The forma-
tion of degenerating giant cell epithelium occurred much
more often in the group where irradiation was made after
formation of tail regenerates. (M.P.G.)

6843

COMPARISON OF HEMATOLOGIC EFFECTS OF IN-
TERNALLY DEPOSITED RADIUM AND PLUTONIUM IN
DOGS. Jean H. Dougherty, John Z. Bowers, Robert C. Bay,
and Panit Keyanonda (Univ. of Utah School of Medicine,
Salt Lake City). Radiology 65, 253-9(1955) Aug.

The results of a study of the intravenous administration of
Pu^{239} and Ra^{226} in adult pure-bred beagles under optimal con-
ditions are given and discussed. (D.E.B.)

6844

THE RELATIVE BIOLOGICAL EFFECTS OF X-RAYS
AND BETA RAYS. William B. Seaman, Michel M. Ter-
Pogossian, and William B. Ittner (Washington Univ. School
of Medicine, St. Louis, Mo.). Radiology 65, 260-4(1955)
Aug.

The relative biologic efficiency of 200-kv x rays and the
β rays of P^{32} in producing erythema on a rabbit's ear was
studied. With equal doses and similar physical distribution
in tissue, the β rays of P^{32} were found to be slightly less
than one-half as efficient as 200-kv x rays in producing
erythema on the rabbit's ear. (auth)

RADIATION HAZARDS AND PROTECTION

6845   AERE-HP/R-1701

Gt. Brit. Atomic Energy Research Establishment, Harwell,
Berks, England.
THE RADIOLOGICAL DOSE TO PERSONS IN THE U. K.
DUE TO DEBRIS FROM NUCLEAR TEST EXPLOSIONS.
N. G. Stewart, R. N. Crooks, and E. M. R. Fisher. June
1955. 27p.

The size distribution of the radioactive dust particles in
the cloud from a nuclear explosion depends both on the
power of the weapon and on the manner in which it is ex-
ploded, whether on the ground, on a tower, or high in the
air. The larger particles fall to earth relatively close to
the site of the explosion, but in every type of burst a con-

siderable fraction of the total radioactivity generated is
contained in fine dust particles whose rate of fall under
gravity is small and which may therefore remain airborne
long enough to diffuse widely throughout the atmosphere
and affect large areas of the earth's surface. An account
is given of the methods that have been used to measure the
amount of radioactive material in the air above U.K., and
the amount deposited on the ground, as a result of all
weapons exploded since January 1951. Based on these
measurements, an estimate is made of the integral gamma
dose received by the average inhabitant of this country
during his lifetime from all nuclear tests held to date. An
estimate is also made of the dose that will ultimately be re-
ceived per individual per generation if bombs continue to
be exploded at the present rate. (auth)

6846

EFFECT OF MAGNESIUM ON THE RESPONSE OF MICE
TO LARGE DOSES OF WHOLE-BODY IRRADIATION.
Henry C. Blount (U. S. Public Health Service Hosp., Seattle).
Radiology 65, 250-2(1955) Aug.

The intraperitoneal injection of 15 mg of magnesium
sulfate in 1 cc of water produced a significant protective
effect in the response of mice to whole-body roentgen irra-
diation. Injections of 5 and 10 mg of magnesium sulfate
failed to exert a significant protective effect as compared
with controls. The results may be in part accounted for by
a fall in body temperature and presumably also by a drop in
metabolic rate. (auth)

6847

EFFECT OF HEMATOPORPHYRIN ON X-RADIATION
SENSITIVITY IN PARAMECIUM. Frank H. J. Figge (Univ.
of Maryland Medical School, Baltimore) and Ralph Wichter-
man (Temple Univ., Philadelphia). Science 122, 468-9(1955)
Sept. 9.

The sensitization of paramecia to radiation by hemato-
porphyrin in the presence of oxygen was demonstrated. The
hypothesis is presented that one of the primary reasons for
the increased x radiation susceptibility of dividing cells is
that they contain higher concentrations of porphyrin than
do differentiated non-dividing cells. (C.H.)

6848

ON THE ARTIFICIAL RADIOACTIVITY IN RAIN WATER.
OBSERVATION OF RADIOACTIVITY IN RAIN WATER IN
TOKYO FROM APRIL TO DECEMBER 1954, AND A
SIMPLE METHOD OF DETERMINING THE DATE OF
EXPLOSION. Fumio Yamasaki and Hideko Kaneko. J. Sci.
Research Inst. (Tokyo) 49, 137-43(1955) June.

Results of observations on the artificial radioactivity in
rain water in Tokyo during the period from April to December
1954, are presented. A sample of rain water was evaporated,
and the radioactivity of the solid residue thus obtained was
measured with an end-window G-M counter tube. A method
of graphical determination of the date of explosion from the
observed decay curve is shown. (auth)

RADIOTHERAPY

6849   TID-5086(2nd Rev.)

Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.
SPECIAL REPORT OF THE MEDICAL DIVISION ON
TELETHERAPY DESIGN PROBLEMS: I. Cs^{137}. Marshall
Brucer. May 15, 1955. 61p. Contract AT-40-1-GEN-33.

Problems in the design of teletherapy devices are dis-

cussed. Consideration is given to the availability of suitable natural or artificial isotopes. The choice of Cs^{137} as a suitable isotope for teletherapy use is explained and the problems of machine design, source, size, and penumbra are advanced. (D.E.B.)

6850

TREATMENT OF MULTIPLE MYELOMA WITH RADIO-ACTIVE IODINE AND RADIOACTIVE IODINATED SERUM ALBUMIN. Joseph P. Kriss, Howard R. Bierman, Sydney F. Thomas, and Robert R. Newell (Stanford Univ. School of Medicine, San Francisco; City of Hope Medical Center, Duarte; and Palo Alto Clinic, Calif.). Radiology 65, 241-9 (1955) Aug.

Treatment of multiple myeloma has been carried out with radioactive iodine and radioactive iodinated serum albumin. Patients gained strength and were relieved of pain but relapse occurred which required re-treatment. The treatment is considered of palliative value only and is suggested only where x-ray therapy is impractical. (D.E.B.)

6851

THE TREATMENT OF BLADDER GROWTHS BY A SOLID INTRAVESICAL COBALT SOURCE. D. G. Bratherton (Christie Hospital and Holt Radium Inst., Manchester, England). Brit. J. Radiol. 28, 508-13(1955) Sept.

A method is described for treating multiple superficial growths by means of a cobalt 60 source held in position in the bladder inside an elastic latex balloon. A total dose of 6000 r on the surface of the balloon is given in two insertions of 3000 r a week apart. Eight of 16 malignant cases are alive at two years, three having required further surgery. Papillomata are rarely completely cured, but are reduced in size and can once again be controlled by cautious diathermy. Complications and contraindications are discussed. (auth)

6852

DOSAGE IN ROTATION THERAPY. Andre Herve. J. belge radiol. 38, No. 2, 227-52(1955). (In French)

The difficulties associated with dosage determinations in rotation therapy are reviewed. A technique of indirect determination is described which is facilitated by a specially designed rotation therapy seat. (C.H.)

6853

CONSIDERATIONS ABOUT THE USE IN CYCLOTHERAPY OF A METHOD OF MEASUREMENT BASED ON THE INTER-POLATION OF THE ENTERING AND EMERGING DOSES. A. Bercy. J. belge radiol. 38, No. 2, 253-67(1955). (In French)

TOXICOLOGY STUDIES

6854

AN EXPERIMENTAL STUDY OF THE EFFECTS OF RARE METALS ON ANIMAL LUNGS. Anthony B. Delahant (Saranac Lake, N. Y.). Arch. Ind. Health 12, 116-20(1955) Aug.

Experiments are described in which six metallic substances, to which personnel may be exposed in the cemented tungsten carbide industry, were introduced intratracheally in guinea pigs. Four of these components proved to be relatively inert (tantalum oxide, tungsten, tungsten carbide and carbon, cobaltic oxide). Two of the components proved to be toxic (cobalt, tungsten carbide and cobalt). (auth)

6855

THE BIOLOGICAL ACTION OF TANTALUM OXIDE. G. W. H. Schepers (Saranac Lake, N. Y.). Arch. Ind. Health 12, 121-3(1955) Aug.

Tantalum oxide, when introduced into the guinea pig lung by the intratracheal technique, produces transient bronchitis, interstitial pneumonitis, and hyperemia with residual focal hypertrophic emphysema and organizing pneumonitis around metallic deposits. The dust is nonfibrogenic. (auth)

6856

THE BIOLOGICAL ACTION OF COBALTIC OXIDE. G. W. H. Schepers (Saranac Lake, N. Y.). Arch. Ind. Health 12, 124-6(1955) Aug.

Intratracheal introduction of 150 mg of cobaltic oxide produces a focal and peribronchial, transient, subacute, inflammatory reaction which becomes virtually completely reversed within one year. On this evidence, cobaltic oxide may be classified as a doubtfully toxic respiratory hazard. (auth)

6857

THE BIOLOGICAL ACTION OF PARTICULATE COBALT METAL. G. W. H. Schepers (Saranac Lake, N. Y.). Arch. Ind. Health 12, 127-33(1955) Aug.

Particulate cobalt metal is an acutely irritating substance when introduced into guinea pig lungs in 50 mg and 25 mg doses. A single 5 mg dose is not lethal, but repetition of such a dose proves to be so. Tolerance to cobalt metal may develop after the initial acute reaction has been overcome. The greatest damage caused by the cobalt metal is the obliterative bronchiolitis. A single instance of bronchial adenomatosis resulted from prolonged focal retention of cobalt metal particles. (auth)

6858

THE BIOLOGICAL ACTION OF PARTICULATE TUNGSTEN METAL. G. W. H. Schepers (Saranac Lake, N. Y.). Arch. Ind. Health 12, 134-6(1955) Aug.

The acute reaction to particulate tungsten when introduced into guinea pig lungs involves the production of focal interstitial pneumonitis and bronchiolitis. While recovery is almost complete after a year, peribronchial, peribronchiolar, and perivascular fibrocellular reactions, with bronchiolitis obliterans and atrophic emphysema, may persist focally. (auth)

6859

THE BIOLOGICAL ACTION OF TUNGSTEN CARBIDE AND CARBON. G. W. H. Schepers (Saranac Lake, N. Y.). Arch. Ind. Health 12, 137-9(1955) Aug.

The acute response to the intratracheal introduction of tungsten carbide and carbon is confined to hyperemia and bronchial catarrh, minor interstitial pneumonitis, and lymphoid hyperplasia. The chronic residua include trapped dust masses and subpleural fibrocellular granulomata. (auth)

6860

THE BIOLOGICAL ACTION OF TUNGSTEN CARBIDE AND COBALT. G. W. H. Schepers (Saranac Lake, N. Y.). Arch. Ind. Health 12, 140-6(1955) Aug.

The intratracheal introduction of 150 mg of tungsten carbide and cobalt in a 10 : 1 ratio produces a transient inflammatory reaction, with residual papillary hypertrophy of bronchial mucosa and peribronchial and periarterial fibrosis in the vicinity of retained particulate matter. (auth)

6861

THE RADON PROBLEM IN DEEP-LEVEL MINING. Duncan

A. Holaday (Salt Lake City, Utah). Arch. Ind. Health 12, 163-6(1955) Aug.

High concentrations of radioactive dust and gas can be demonstrated in a high proportion of uranium mines. However, appreciable concentrations have likewise been demonstrated in many nonuranium mines. Adequate data are not available for interpreting these concentrations in terms of effects on human health, but it is very important that standards be agreed upon. It is urged, therefore, that a concerted effort be made to study records of miners who have worked for years in nonuranium mines, in hopes that data bearing upon the establishment of reasonable maximal allowable concentrations can be obtained. (auth)

6862

THE DISABILITY FOUND IN PERSONS EXPOSED TO CERTAIN BERYLLIUM COMPOUNDS. Harriet L. Hardy (Boston, Mass.). Arch. Ind. Health 12, 174-81(1955) Aug.

Epidemiological, industrial hygiene, clinical, and animal experimental evidence documents the conclusion that distinctive disease occurs in beryllium-using industries. Various degrees of worker disability and methods of diagnosis are discussed. (D.E.B.)

TRACER APPLICATIONS

6863   UCRL-3063

California. Univ., Berkeley. Radiation Lab.
GLUCOSE OXIDATION BY NORMAL AND VIRUS-INFECTED MICE. Benjamin V. Siegel and Ann M. Hughes. July 8, 1955. 9p. Contract W-7405-eng-48.

The respiration of uniformly labeled glucose-C^{14} by normal and virus-infected mice was studied over an infection period of 10 days. The rate and extent of viral multiplication apparently has no effect on the rate and extent of glucose metabolism by the infected intact host. (auth)

6864

THE USE OF CHROMIUM AS A RED-CELL TAG. D. M. Donohue, A. G. Motulsky, Eloise R. Giblett, G. Pirzio-Biroli, V. Viranuvatti, and C. A. Finch (Univ. of Washington School of Medicine, Seattle). Brit. J. Haematol. 1, 249-63(1955) July.

The use of Cr^{51} as a red-cell tag in determinations of red-cell volume, measurements of viability of normal, abnormal, and stored red cells, and the tissue localization of Cr^{51} after red-cell breakdown are discussed. Results are presented from both human studies and animal experiments which illustrate the advantages and limitations of this isotope as a red-cell tag. (C.H.)

CHEMISTRY

6865   ACCO-68

American Cyanamid Co. Atomic Energy Div. Raw
   Materials Development Lab., Winchester, Mass.
A SUMMARY REPORT ON THE ION EXCHANGE PROCESS FOR THE RECOVERY OF URANIUM. David Kaufman and George W. Lower. [1954?]. 52p. Contract AT(49-1)-533.

The development of the ion exchange process for the recovery of uranium from acid and carbonate leach liquors is summarized. The historical background of the use of ion exchange for uranium recovery as well as theoretical

and practical considerations are covered. Complex ion formation and the adsorption and elution processes are detailed. Factors effecting uranium adsorption and elution as well as a discussion of the effect of extraneous ions are discussed in detail. (auth)

6866   AD-55143

Pennsylvania State Univ., University Park.
THERMODYNAMIC PROPERTIES OF BORON AND ALUMINUM COMPOUNDS. Progress Report No. 3. Dept. of Chemistry. Thomas Wartik, Milton Linevsky, and Herbert Bowkley. Mar. 1, 1955. 72p. Contract AF18(600)-311.

The spectroscopic investigation of diboron tetrachloride, B_2Cl_4, was continued. Additional infrared data for B_2Cl_4 are reported. A new method for the preparation of tetraborane, B_4H_{10}, was developed. The design and performance of an adiabatic calorimeter for low-temperature measurements are outlined. Several thermodynamic properties of B_4H_{10} were determined, including heat capacity and vapor pressure over a low-temperature range. The thermal properties of B_4H_{10} were compared with those of other boron hydrides and the four-carbon paraffins. (For preceding period see AD-19456.) (C.W.H.)

6867   AGC-1229-4

Aerojet General Corp., Azusa, Calif.
INORGANIC AND SEMI-ORGANIC POLYMERS. Bimonthly Report [for] Period June 1, through July 31, 1955. C. L. Randolph. July 18, 1955. 13p. Contract AF33(616)-2739.

The condensation of benzeneboronic and cyclohexanephosphonic acids was carried out for the first time yielding a water-resistant white solid which does not melt at 300°C. The synthesis of a new resin, which melted at 60 to 65°C, was achieved by heating an equimolar mixture of diphenylsilanediol and cyclohexanephosphonyl chloride. The water sensitivity of this clear, brittle material was decreased slightly by treatment with butyl alcohol. (auth)

6868   ANL-5451

Argonne National Lab., Lemont, Ill.
CHEMISTRY DIVISION SUMMARY REPORT [FOR] JANUARY THROUGH JUNE 1953. (Unclassified Section). J. R. Gilbreath, D. W. Osborne, and A. F. Martin, comps. Aug. 8, 1955. 89p. Contract W-31-109-eng-38.

Further studies were carried out on the effects of heat treatment on the absorption spectra of irradiated LiF, KBr, LiCl, NaF, NaBr, and CsBr. The fluorescence and thermoluminescence of ice under x irradiation, paramagnetic resonances in irradiated glasses, expansion of Cu bombarded by high energy deuterons, radiation chemistry of formic acid—oxygen system were reported. The structure of KRe, density and thermal expansion of $CoCl_2$ and ethyl iodide, thermal conductivity of UO_2 and MgO, thermionic properties and vapor pressure of U, thermal capacity of UF_4, and the dissociation pressure of $NpBr_4$ were determined. New and stronger exposures of Am spectra were made with a spectrograph using Ag electrodes. The water-oxygen thermal isotopic exchange reaction was studied. The heats of solution of $Th(NO_3)_4-5H_2O$ in water and various organic solvents, the vapor density of HF and the electric conductivity of $Br-BrF_3$ system were measured. Observations were made on the H isotope effects in the oxidation of benzyl alcohol by aqueous acid chromate. A surface α-activity distribution scanner is described. The scintillation response of NaI to photons and LiF to deuter-

ons is studied. A study of the effects of electroplating on graphite crystals indicates an appreciable potential drop for the case of Cu, across the Cu—graphite surface. Procedures are outlined for the determination of B in Pb—B systems, and Sn in Sn—Zr alloys. A standard T source has been prepared by dilution of mass-spectrometrically analyzed T. (J.E.D.)

6869 CCC-1024-TR-129
Pittsburgh. Univ.
IODOMETRIC MONITORING OF BORANE-CONTAINING ATMOSPHERES. W. H. Hill, G. J. Levinskas, and W. J. Novick. Aug. 12, 1955. 12p.

A new method is described for the analysis of boranes by ordinary iodometric procedure. The large ratio of iodine reacting with a borane makes possible the use of a Tutwiler Burette for monitoring animal exposure chambers and plant atmospheres in those cases where the borane is not too easily hydrolyzed by water. (auth)

6870 CCC-1024-TR-132
Pennsylvania State Univ., University Park.
THE REACTIVITY OF DIBORON TETRACHLORIDE TOWARD SOME OF THE NON-METALLIC ELEMENTS AND TOWARD THE HYDROGEN COMPOUNDS OF THESE ELEMENTS. T. J. Wartik and E. F. Apple. Aug. 22, 1955. 110p.

The reactivity of diborane tetrachloride toward some of the non-metallic elements (Cl_2, Br_2, I_2, O_2, S, P), certain hydrogen compounds of these elements (HI, H_2O, H_2S, PH_3), cyanogen, and dimethyl sulfide was studied. As a result, a number of new diborane tetrachloride derivatives were prepared. (C.W.H.)

6871 CCC-1024-TR-133
Virginia Polytechnic Inst., Blacksburg.
THE ELECTROLYSIS OF ALKYL LITHIUM COMPOUNDS AND ETHYLMAGNESIUM BROMIDE IN LITHIUM BOROHYDRIDE—DIETHYL ETHER SOLUTIONS. J. L. Disney and N. F. Murphy. Aug. 25, 1955. 26p.

Alkyl lithium compounds were prepared and their conductivities in various solvents were measured. The solubility and conductivity of lithium borohydride and ethylmagnesium bromide in $(C_2H_5)_2O$ were measured and the solutions electrolyzed. No reaction was observed between lithium borohydride and ethylmagnesium bromide or the alkyl lithium compounds under the conditions tested. (C.W.H.)

6872 KAPL-1398
Knolls Atomic Power Lab., Schenectady, N. Y.
SOLUBILITY OF BARIUM METAL AND BARIUM OXIDE IN SODIUM. J. R. Gould. Sept. 1, 1955. 17p. Contract W-31-109-Eng-52.

Because of the interest in barium metal as an inhibitor of mass transport in liquid sodium systems, the following properties of barium in sodium were determined. The solubility of barium in sodium varied from 1 to 3.8 wt. % in the temperature range of 250 to 700°C. The variation in the solubility (S = wt.%) of barium with temperature (°K) may be expressed as: $\ln S = 2.76 - 1.39 \times 10^3/T$. The heat of solution of barium in sodium is approximately 2800 cal/mole of barium. Barium monoxide solubility in sodium at 500°C is < 0.05 wt.%. (auth)

6873 NP-5735
Goodrich (B. F.) Co. Research Center, Brecksville, Ohio.
DEVELOPMENT OF INORGANIC POLYMER SYSTEMS.

Bimonthly Progress Report No. 4 [For June 1, 1955—July 31, 1955]. C. F. Gibbs, H. Tucker, G. Shkapenko, and J. C. Park. 18p. Project No. 5(7-7340). Contract AF33(616)-2744.

The preparation of polymers and model compounds containing aluminum—oxygen and silicon is described. The model compounds sought are exemplified by Al(O Si ϕ_3)$_3$. Infrared spectra are given for diisopropoxy aluminum acetylacetonate and dichloro aluminum acetylacetonate. Comparison with the spectra of acetylacetone and aluminum acetylacetonate leads to the inference that the quadricovalent acetylacetonate compounds do have chelate structures. A mechanism for the thermal decomposition of aluminum isopropoxide is elucidated. (auth)

6874 NP-5755
Cornell Univ., Ithaca, N. Y.
KINETICS OF FAST REACTIONS. Technical Report No. 2 for period November 1, 1952 to July 1, 1955. Dept. of Chemistry. S. H. Bauer, Milton Blander, Allan Shepp, James J. Klein, C. C. Peterson, and Eliza Pollard. July 1, 1955. 212p. Project NR 051-242. Contract N6 onr-264 (17).

The investigations on the relative rates of the gas phase association reactions between BF_3 and various amines were continued. High resolution spectra of $(CH_3)_3N$ and infrared spectra of a series of related addition compounds of $(CH_3)_3N$ and BF_3 are presented. A theoretical treatment of an experiment to determine the rate constant of the reaction, $R_3N_{(g)} + BX_{3(g)} = R_3N:BX_{3(g)}$, is outlined. A heat-transfer mechanism is suggested to account for experimental results found in diffusion-controlled gas-phase reactions. An analysis of the kinetics of decomposition of molecular O_2, formation of ozone, and the isotopic exchange in gaseous O_2, as these occur in a single pulse shock tube is presented. The phase lag technique for the measurement of fast reaction rates has been used to estimate the entropy gain of a system which has been subjected to a periodic perturbation. The thermodynamic—statistical criterion for bond tightness has been extended to the association of polar gases, formation of activated complexes, and adsorption of gases on solids. (For preceding report in series see M-5062.) (C.W.H.)

6875 NRL-Memo-516
Naval Research Lab., Washington, D. C.
THERMAL AND RELATED PHYSICAL PROPERTIES OF MOLTEN MATERIALS. Progress Report No. 14 [for] May 1—August 31, 1955. B. E. Walker, C. T. Ewing, and R. R. Miller. Aug. 22, 1955. 9p.

Heat content and heat capacity measurements on salt "B" were completed from 30 to 900°C. Two breaks were found in the heat content and specific heat curves, at about 412°C in the solid range, and at about 580°C in the liquid range. Equations and values for the heat content and heat capacity have been furnished in this report. The heat capacity value for the liquid range 580 to 900°C decreases linearly from approximately 0.27 cal/g-°C to 0.23 cal/g-°C. Preliminary measurements of heat content and heat capacity were made on salt "E", which was the salt required in evaluating the hypothesis presented in the last quarterly report. Values in the solid range agreed with calculated values to about 1% in heat capacity and heat content. Only one heat capacity value has been determined in the liquid range and it is about 0.452 cal/g-°C at 562°C. The new thermal conductivity apparatus has been nearly

completed. Welding of this apparatus is being delayed for the assembly of a new welding box, patterned after a model now in use at ORNL, and providing an inert atmosphere for performing heli-arc welding. Calibration of thermocouples for the conductivity systems is now in progress. (For preceding period see NRL-Memo-470.) (auth)

6876 NYO-7402(Pt.1)

Columbia Univ., New York.

PARTICLE SIZE DISTRIBUTION AND SPECIFIC SURFACE STUDIES ON PHOSPHATE SLIMES. Progress Report for September 1, 1954–July 30, 1955. Victor K. La Mer, Robert H. Smellie, Jr., and Pui-Kum Lee. Aug. 15, 1955. 28p. Contract AT(30-1)-1189.

The linear relation between Pm (flocculant concentration for maximum filtration rate) and W^2 (where W is percent solids) suggest that this relationship is equivalent to P vs. $(area)^2$, since for a given powder W varies as surface area if the sampling is representative. This particular possibility is not conclusive due to the uncertainty of the contribution of the chemistry of the surface. In order to establish whether or not Pm vs. W^2 is specifically equivalent to Pm vs. $(area)^2$ $Ca_3(PO_4)_2$ powder was fractionated to obtain samples having different specific areas. The determination of Pm vs. W^2 for $Ca_3(PO_4)_2$ samples of different specific area should establish whether or not Pm vs. W^2 and Pm vs. $(area)^2$ are equivalent; also whether or not the mass or volume factor exists also in floc formation. It is anticipated that it will be possible to determine from the re-filtration rate of the untreated sample and a knowledge of its chemical composition the amount of a given flocculating agent necessary to produce maximum filtration rate and also what that rate will be as a function of solid content. (For preceding period see NYO-3289.) (auth)

6877 RMO-2016

International Minerals and Chemical Corp., Chicago.

URANIUM PRODUCTION—PROCESS DESIGNS FOR LEACHED ZONE PLANTS. VOLUME V. PHOSPHATE RECOVERY SECTION. D. F. Clements, R. F. McCullough, and E. E. Wrege. Sept. 8, 1953. Decl. Apr. 13, 1955. 65p. Contract AT(49-1)-545. (IMCC-2036)

Recovery of phosphate values from the aqueous raffinate produced in the uranium tetrafluoride extraction operation is considered. Basic design and operating economic information for Phosphate Recovery Sections of plants sized to produce 450, 225 and 100 tons of uranium per year are presented. (auth)

6878 RMO-2017

International Minerals and Chemical Corp., Chicago.

URANIUM PRODUCTION—PROCESS DESIGNS FOR LEACHED ZONE PLANTS. VOLUME VI. AMMONIUM SULFATE DECOMPOSITION AND SULFURIC ACID PLANTS. D. F. Clements, W. B. Williams, R. F. McCullough, and E. E. Wrege. Sept. 21, 1953. Decl. Apr. 13, 1955. 52p. Contract AT(49-1)-545. (IMCC-2037)

Process design and cost estimates of facilities for the production of ammonium hydroxide and sulfuric acid are presented. These facilities have been integrated into the leached zone processing plants which produce 450, 225 and 100 tons of uranium per year. The process involves the catalytic decomposition of ammonium sulfate to recover the ammonia and sulfur values. Capital costs of the decomposition reactor and auxiliary equipment in the present process design are relatively high. It is believed that

revisions of parts of the present process would bring about a considerable reduction in the capital costs. These revisions include redesigning the decomposition reactor and modifying other steps in the process. The design also includes facilities necessary for the production of sulfuric acid from elemental sulfur. The total amount of acid produced by both methods corresponds to that consumed in the leached zone processing plant. Ammonia produced in the decomposition plant constitutes 44% of that consumed in the leached zone processing. The decomposition process involves contacting granular ammonium sulfate with zinc oxide at elevated temperatures. Zinc oxide acts as a catalyst in the reaction and is recycled. Decomposition is carried out in a gravitating bed of alundum spheres which have been impregnated with zinc oxide. Granular ammonium sulfate is distributed on the spheres at the top of the bed. As the bed descends the reaction proceeds and the gaseous products are evolved. All products are withdrawn in the gas phase. Heat is supplied by means of hot flue gas which comes in direct contact with the flowing reactants. The reactor off-gas streams are treated by conventional means to yield the final products of ammonium hydroxide and sulfuric acid. (auth)

6879 RMO-2019

International Minerals and Chemical Corp., Chicago.

URANIUM PRODUCTION—PROCESS DESIGNS FOR LEACHED ZONE PLANTS. VOLUME VIII. UTILITIES SECTION. D. F. Clements, W. B. Williams, R. F. McCullough, and E. E. Wrege. Sept. 1953. Decl. Apr. 13, 1955. 89p. Contract AT(49-1)-545. (IMCC-2039)

The design and cost estimates for the utilities required for plants processing the leached-zone portion of the Florida phosphate area are presented. Production of 450, 225 and 100 tons of uranium per year, with recovery of the alumina and phosphatic values is considered. (auth)

6880 UCRL-3011

California. Univ., Berkeley. Radiation Lab.

RAPID REACTIONS: KINETICS OF THE FORMATION OF THE FERRIC THIOCYANATE COMPLEX (thesis). John Frederick Below, Jr. June 1955. 116p. Contract W-7405-eng-48.

6881 UCRL-4513

California. Univ., Livermore. Radiation Lab.

THE ACID PROPERTIES OF METHYL BORATE. Saul Siegel and William L. Jolly. April 15, 1955. 16p. Contract W-7405-eng-48.

The physical and chemical properties of methyl borate ammoniate have been studied. The saturation pressure as a function of temperature and the vapor molecular weight have been determined. These data indicate methyl borate to be a weaker acid than anticipated; double-bond resonance and steric hindrance apparently play a part in weakening the acidity. Studies were also made of the reaction of methyl borate with sodium amide and of the reactivity of methyl borate ammoniate with sodium in liquid ammonia. (auth)

6882 WADC-TR-55-240

Lehigh Univ., Bethlehem, Penna.

BASIC FACTORS IN THE FORMATION AND STABILITY OF NON-SOAP LUBRICATING GREASES. [Summary Report for the period April 15, 1954 to April 15, 1955]. Apr. 1955. 97p. Project No. AF 7331. Contract AF 33(616)-2440.

Pertinent physical properties of several oils and surface characteristics of various types of thickening agents have been determined in order to index the nature and extent of the oil-thickener interface in non-soap grease systems. In addition, modifications of the oil thickener interfacial region by traces of water and by polar organic additives have been studied. Ramifications of the alteration of this interfacial zone on gel structure and stability of grease systems are discussed. (auth)

6883 AEC-tr-2223
LARGE PARTICLES AND SURFACE SEPARATION PHENOMENA. I. A NEW EMULSIFYING MACHINE. DEPENDENCE OF THE PARTICLE RADIUS ON THE MECHANICAL CONDITIONS. L. Jürgen-Lohman[n]. Translated by Diane [E.] Cardamone from Kolloid-Z. 124, 41-3 (1951). 8p.

The design and operating characteristics of a new emulsifying machine are given. A comparison of the Turbomixer and the new emulsifying machine is made. (D.E.B.)

6884 AEC-tr-2224
GLOBULE SIZE AND INTERFACIAL TENSION IN EMULSIONS. II. DEPENDENCE OF DROPLET RADII ON EMULSIFIER CONCENTRATION AND INTERFACIAL TENSION. L. Jürgen-Lohmann. Translated by K. S. Bevis from Kolloid-Z. 124, 77-82(1951). 10p.

In emulsions of various components, the dependence of particle size on emulsifier concentration in the intermicellar liquid and on the interfacial tension is measured. Interfacial tension is not essential. Much more important in exerting the dominating influence is the nature of the liquid to be dispersed. (auth)

6885 AEC-tr-2226
CHEMISTRY OF ALUMINA COMPOUNDS. T. Hennig. Translated by Diane E. Cardamone from Chem. Tech. 1, 36-8(1949). 9p.

The chemistry of the tri-valent, amphoteric, and easily hydrolyzed alumina compounds is outlined. Formation, properties, and technical applications are tabulated for several aluminum oxides and hydroxides. Technical processes for the production of alumina are mentioned. (C.W.H.)

6886 AEC-tr-2228
FLUORITE PHASE IN THE ZrO_2-CaO SYSTEM. ITS LATTICE DEFECT AND DEVELOPMENT OF ELECTRICAL CONDUCTIVITY. F. Hund. Translated from Z. physik. Chem. 199, 142-51(1952). 7p. Available from Associated Technical Services (Trans. 83G6G), East Orange, N. J.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 6-3528.

6887 AERE-Lib/Trans-526
THE CHEMISTRY OF HELIUM AND HELIUM COMPOUNDS: THE COMBINATION OF HELIUM WITH URANIUM BY CHEMICAL CATHODIC ACTIVATION AND THE THERMAL DECOMPOSITION OF THE COMPOUND FORMED. H. Damianovich. Translated by J. B. Sykes from Anales asoc. quim. argentina 27, 64-73(1939). 6p.

By chemical cathodic activation, uranium fixes helium in proportions varying from 6 to 9 mm^3/mg. The decomposition of the helium—uranium complex is endothermic, since it increases with temperature. The curve of elimination of helium as a function of temperature shows a maximum between 60 and 80°C. The helium—uranium complex is less stable than those which helium forms with platinum, iron

and palladium. These facts may be used to explain the non-radioactive origin of part of the helium contained in minerals and gaseous wells. (auth)

6888
INTERMOLECULAR CARBON ISOTOPE EFFECT IN THE DECARBOXYLATION OF THE MONO-ANION OF MALONIC ACID IN QUINOLINE SOLUTION. Peter E. Yankwich and Harold S. Weber (Univ. of Illinois, Urbana). J. Am. Chem. Soc. 77, 4513-16(1955) Sept. 5.

The intermolecular carbon isotope effect in the decarboxylation of the mono-anion of malonic acid in quinoline solution has been investigated over the temperature range 67.5 to 119°. From consideration of the effects of solvent and added 1-butylpiperidine on the rate of decarboxylation and the position of the carbonyl absorption band, it is concluded that there may be in the system studied some observable isotope effect due to the impression upon the bond rupture process of equilibria antecedent to it involving the anionic solute and the quinoline solvent. The effect of possible non-random distribution of C^{13} among the various anionic species is considered also. (auth)

6889
STUDIES IN LOW CONCENTRATION CHEMISTRY. XI. THE ADSORPTION OF SULFATE AND SCANDIUM IONS. George K. Schweitzer and Martin R. Bomar (State Univ. of Iowa, Iowa City). J. Am. Chem. Soc. 77, 4528-32(1955) Sept. 5.

Radiotracer studies were made of the adsorption of sulfate and scandium ions from low concentration solutions onto charcoal and various insoluble compounds. Qualitative investigations on the adsorbent characteristics of insoluble substances, adsorption rates, effects of pH and acid used to adjust the pH upon adsorption onto charcoal, and the adsorption-concentration relationships were included. (J.E.D.)

6890
THE STRUCTURAL FATE OF THE CARBONYL CARBON ATOM IN THE TROPOLONE—BENZOIC ACID REARRANGEMENT. W. von E. Doering and Donald B. Denney (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 77, 4619-22(1955) Sept. 5.

The rearrangement of 2,4,7-tribromotropone and 2,7-dibromotropone, both labeled in the carbonyl group with C^{14} has given 2,4- (and 2,5-)-dibromobenzoic acid and 2-bromobenzoic acid, respectively, with all the radioactivity in the carboxyl group. It is concluded that the carbon atom of the carboxyl group is derived from the carbonyl group in rearrangements of tropolone (and derivatives) to benzoic acid (and derivatives). In the ring enlargement of ketones by diazomethane it has been shown incidentally that the carbonyl group retains its integrity during rearrangement. (auth)

6891
INVESTIGATION OF THE EFFECTS OF MOLECULAR STRUCTURE ON THE VELOCITY OF IONIC AND ATOMIC ISOTOPIC EXCHANGE REACTIONS. II. EFFECT OF ISOMERIZATION OF THE RADICAL AND INTRODUCTION OF DOUBLE BONDS ON VELOCITY OF ISOTOPIC EXCHANGE OF ALKYL HALIDES WITH HALIDE IONS. M. B. Neiman, V. B. Miller, and Yu. M. Shapovalov (Inst. of Chemical Physics, Moscow). Zhur. Fiz. Khim. 29, 892-7 (1955) May. (In Russian)

6892
INORGANIC OXIDATION-REDUCTION REACTIONS IN SOLUTION. ELECTRON TRANSFERS. Bruno J.

Zwolinski (Stanford Research Inst., Calif.) and Rudolph J. Marcus and Henry Eyring (Univ. of Utah, Salt Lake City). Chem. Revs. 55, 157-80(1955) Feb.

A general discussion is given of oxidation-reduction reactions involving electron transfer, including kinetic analysis and theory of such reactions. (B.J.H.)

6893

ORGANIC COMPOUNDS OF THE METALS. W. Wardlaw and D. C. Bradley. Endeavour 14, 140-5(1955) July.

The chemistry of organometallic compounds is reviewed. The preparation and properties of several organic compounds of Si, Ti, Zr, Hf, and Th are discussed. (C.W.H.)

6894

SEMIEMPIRICAL STUDY OF THE H_2Cl TRANSITION COMPLEX THROUGH THE USE OF HYDROGEN ISOTOPE EFFECTS. Jacob Bigeleisen and Max Wolfsberg (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 23, 1535-9(1955) Aug.

Linear and triangular structures for the H_2Cl transition complex have been analyzed in terms of normal vibration theory and by an evaluation of the experimental data on the effect of hydrogen isotope substitution on the rate of reaction of hydrogen molecules and chlorine atoms. The frequencies of the bending vibrations are probably sufficiently small that their contribution to the relative rates can be expressed in terms of a small quantum correction of the order of $(hc/kT)^2(\omega_{II}^2 - \omega_{D,T}^2/24)$. The near classical behavior of the bending frequencies for both linear and triangular structures of the H_2Cl complex serves to reduce the ratio of the frequency factors, $A_H/A_{D,T}$ in the Arrhenius equation from that expected from structural considerations alone. Quantitative agreement is found between the calculated and experimentally determined frequency factor ratios for the triangular complex. The "symmetrical" stretching frequencies, for both linear and triangular complexes respectively, have been evaluated from the relative rates of reaction of H_2 and HT with chlorine atoms at 0°C and the known properties of the isotopic hydrogen molecules. This empirically evaluated parameter, together with thermodynamic data, and an estimate of the tunnel correction, suffice to calculate the relative rates of reaction of the isotopic hydrogen molecules with chlorine atoms as a function of temperature. Good agreement is found between the calculated rates for both linear and triangular structures and the available experimental data on HD, D_2, and HT. (auth)

6895

BARRIER HEIGHT AND THERMODYNAMIC FUNCTIONS OF GASEOUS HNO_3 AND DNO_3. Ann Palm and Martin Kilpatrick (Illinois Inst. of Tech., Chicago). J. Chem. Phys. 23, 1562-3(1955) Aug.

The thermodynamic functions of HNO_3 and DNO_3 for the ideal gaseous state at 1 atm./pressure were calculated from measurements of the vibrational spectra. The structure parameters as well as numerical values expressing the barrier height and the torsional energy levels in terms of θ and the eigenvalues a_r contained in the Mathieu function were also evaluated. (C.W.H.)

ANALYTICAL PROCEDURES

6896   IDO-14318

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
MANUAL OF MASS AND EMISSION SPECTROSCOPY

METHODS USED AT THE CHEMICAL PROCESSING PLANT. W. E. Duffy, G. V. Wheeler, and T. D. Morgan, eds. June 30, 1955. 61p. Contract AT(10-1)-205.

Mass and emission spectroscopy methods are described in this manual which are routinely used at the Idaho Chemical Processing Plant. Included among the mass methods is the determination of uranium concentration by an isotope dilution technique. The emission methods run the gamut from a general qualitative method to the quantitative determination of impurities in concentrated uranyl nitrate solutions. Also described is an x-ray fluorescence method for the determination of certain constituents in stainless steels. (auth)

6897   IDO-14349

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
AN ULTRAVIOLET SPECTROPHOTOMETRIC DETERMINATION OF URANIUM. Bernice E. Paige, Maxine C. Elliott, and James E. Rein. Aug. 15, 1955. 24p. Contract AT(10-1)-205.

An ultraviolet spectrophotometric method is described for the determination of uranium based on the absorbing complex of uranium(VI) with tributylphosphate (TBP). The complex is formed by extracting uranium(VI) from an aqueous 6M sodium nitrate solution into 25% TBP—75% inert diluent. This extraction also serves to separate the uranium from many interfering impurities. The reliable range for aqueous samples is 0.0025 to 5.0 mg of uranium per ml. (auth)

6898   JENER-36

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.
ON A SPECTROCHEMICAL METHOD FOR ANALYSIS OF RADIOACTIVE SOLUTIONS. J. Haaland. May 1955. 12p.

The method described was developed when the problem arose, to analyze active solutions containing I^{131}. The solutions, used for medical purposes, are now examined for 16 elements down to concentrations below 10 μg/ml. Due to the the health hazard in burning active solutions—the samples in question contain from 2-5 mC I^{131}—an enclosed spark discharge chamber has been constructed. Graphite electrodes are used, and the sample is concentrated in thin plates on the sparking surfaces of the electrode pair. Evaporation of the sample solution on metal electrodes was not satisfactory here because the relatively high concentration of sodium salts in the solution deposed a salt crust on the surface. Graphite is too porous for direct evaporation. In the following, the working technique is described in detail and necessary data are given. (auth)

6899   UCLA-342

California. Univ., Los Angeles. Atomic Energy Project.
A STUDY OF THE YOLK PROTEINS OF FROG EGGS BY PHYSICAL AND CHEMICAL MEANS. O. A. Schjeide, E. Levi, and R. A. Flickinger. Aug. 26, 1955. 20p. Contract AT-04-1-GEN-12.

The essential similarity of the main components of the yolk proteins, vitellin and livetin, has been demonstrated by analytical ultracentrifugation, electrophoresis, and lipide analyses. These data provide evidence for the conversion of vitellin to livetin during embryonic development. Further evidence for such a conversion is seen in the change towards a higher livetin to vitellin ratio in the cells as the embryo developed. (auth)

6900 UCRL-3081
California. Univ., Berkeley. Radiation Lab.
ISOLATION AND QUANTITATIVE ESTIMATION OF
IODIDE, THYROXINE, AND SUBSTANCES RELATED TO
THYROXINE BY MEANS OF AN ANION EXCHANGE RES-
IN. P. Blanquet, R. W. Dunn, and C. A. Tobias. July
15, 1955. 5p. Contract W-7405-eng-48.

An ion-exchange method is being developed for the rapid
determination of mineral and protein-bound iodine and of
other substances of importance in thyroid metabolism.
(C.W.H.)

6901

ANALYSIS OF GAS MIXTURES BY MEANS OF BETA RAY
TRANSMISSION MEASUREMENTS. Åke Norhagen and
Erik Odeblad (Karolinska Inst., Stockholm). Acta Radiol.
43, 487-92(1955) June.

Transmission measurements of beta particles from S^{35}
through gases have been performed and mixtures of He and
O_2, He and air, He and N_2 and O_2 and N_2 analyzed. An
approximately linear relation between the partial pressures
of the gas mixtures and the logarithm of the transmitted
number of beta particles is reported. (auth)

6902

ALIZARIN-S, A REAGENT FOR THORIUM. A GRAVI-
METRIC, COLORIMETRIC, AND SPECTROPHOTOMETRIC
STUDY. D. V. N. Sarma and Bh. S. V. Raghava Rao
(Andhra Univ., Waltair, India). Anal. Chim. Acta 13, 142-9
(1955) Aug.

The claim of Beck in the use of alizarin-S for separating
cerite earths from thorium could not be substantiated. De-
tailed conditions for estimating from 0.00095 to 6.3 mg of
thorium dioxide in 50 ml of solution by the method of Rao
and Murthy are described. The absorption characteristics
of alizarin-S and its thorium complex have been studied in
their dependance on pH. The thorium complex has been
shown by adopting different optical methods to correspond
to Th−Al−S (a stoichiometric ratio of 1 : 1) which is also
confirmed from gravimetric analyses. The dissociation
coefficient of the complex at pH 2.7 has been computed to
be less than 1.10^{-8}. (auth)

6903

PHOTOMETRIC DETERMINATION OF GALLIUM WITH
RHODAMINE B. Hiroshi Onishi and E. B. Sandell (Univ. of
Minnesota, Minneapolis). Anal. Chim. Acta 13, 159-64
(1955) Aug.

Gallium is extractable as rhodamine B chlorogallate with
benzene from 6M hydrochloric acid, and can be determined
absorptiometrically or fluorimetrically in the extract. The
interference of iron(III) is avoided by first separating
gallium by extraction with isopropyl ether from hydrochloric
acid solution containing titanous chloride. Traces of gallium
can be determined in the presence of aluminium, indium,
zinc, antimony, thallium, tungsten and other elements. (auth)

6904

ESTIMATION OF SODIUM IN ALUMINIUM USING THE
FLAME PHOTOMETER. H. F. Hourigan and J. W.
Robinson (Post Office Engineering Dept., Birmingham,
England). Anal. Chim. Acta 13, 179-82(1955) Aug.

A flame photometric method of estimating sodium in
aluminum has been developed. It was found that the concen-
tration of aluminum altered the intensity of the sodium
flame. This necessitated using standard conditions. (auth)

6905

HIGH FREQUENCY TITRATIONS INVOLVING CHELATION
WITH ETHYLENEDIAMINETETRAACETIC ACID. IV.
COMPLEXATION OF THORIUM NITRATE. Reinosuke
Hara and Philip W. West (Louisiana State Univ., Baton
Rouge). Anal. Chim. Acta 13, 189-94(1955) Aug.

High-frequency titrations have confirmed the reacting
ratio of thorium to ethylenediaminetetraacetic acid to be 1 to
1. It has also been shown that thorium can be determined by
oscillometric titration using either the hydrogen release
method or the direct titration technique. The method is
especially interesting for the determination of small amounts
of thorium in dilute solution. (auth)

6906

SEPARATION OF RARE-EARTH ELEMENTS. M. Lederer
(Laboratoire Curie, Paris). Nature 176, 462-3(1955) Sept. 3.

Chromatographic separations of the rare earths using
ethanol−hydrochloric acid mixtures as solvents were in-
vestigated. Good separations of La−Dy mixtures were
achieved. (C.W.H.)

6907

COLORIMETRIC DETERMINATION OF NIOBIUM IN THE
PRESENCE OF TITANIUM. Roy J. Mundy (National Lead
Co., Sayreville, N. J.). Anal. Chem. 27, 1408-12(1955)
Sept.

A colorimetric method for the determination of Nb in the
presence of Ti was developed. It is based on the different
absorption maxima of Ti and Nb thiocyanate complexes at
360 and 400 mμ. The absorption spectra of impurities and
their effects on the Nb results were also investigated.
(C.W.H.)

6908

USE OF CAPILLARY TRAP IN MICRODETERMINATION OF
CARBON. Ben D. Holt (Argonne National Lab., Lemont, Ill.).
Anal. Chem. 27, 1500-1(1955) Sept.

A rapid and precise manometric method is described for
the measurement of carbon dioxide produced by combustion
in microdetermination of carbon. In the very low range, 1 γ
of carbon corresponds to a manometer reading of 4 mm.
Excluding the effects of sample loading, the blank is
negligible. With the sacrifice of some precision, the
measuring unit may be revised to possess a dual range,
accommodating both micro and macro amounts of carbon.
(auth)

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

6909 AERE-Lib/Trans-527
THE PROBLEM OF ELEMENTS 97 AND 98. A. P. Znoiko
and V. I. Semishin. Translated by V. Beak from Doklady
Akad. Nauk S.S.S.R. 74, 917-19(1950). 3p.

The periodic law of the chemical elements as formulated
by Mendeleev is used to predict the occurrence and
characteristics of elements 97 and 98. The name Mendelevium
was proposed for element 97. (D.E.B.)

6910

RELIABILITY OF ATOMIC MASSES IN THE CHROMIUM−
GERMANIUM REGION. John T. Kerr, John G. V. Taylor,
and Henry E. Duckworth (McMaster Univ., Hamilton, Ont.,
Canada). Nature 176, 458-9(1955) Sept. 3.

Calculations of atomic mass differences in the region Cr
to Ge, using mass spectroscopic and transmutation data,
indicate that the atomic masses of Ni determined mass

spectroscopically are too low by $\sim 60 \times 10^{-5}$ atomic mass units. (C.W.H.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

6911   UCRL-3088

California. Univ., Berkeley. Radiation Lab.
THE CRYSTAL STRUCTURE OF INDIUM(I) IODIDE.
Robert E. Jones and David H. Templeton. Aug. 3, 1955.
3p. Contract W-7405-eng-48.

The crystal structure of InI grown at 300°C in an evacuated tube was studied. Photographs reveal an orthorhombic unit cell with dimension: a = 4.75 A, b = 12.76 A, c = 4.91 A. For Z = 4, the density is 5.39 g/cc. Atomic parameters are determined and hkO intensities estimated. Atomic neighbors, their kind, and distance are given. (D.E.B.)

6912   AEC-tr-2214

CRYSTAL STRUCTURES OF COMPOUNDS OF THE PLATINUM GROUP METALS. STRUCTURES OF RhF$_3$, PdF$_2$— TYPE FeF$_3$, AlF$_3$. N. V. Belov. Translated from Izvest. Sektora Platiny i Drug. Blagorod. Metal. Inst. Obshchei Neorg. Khim. Akad. Nauk S.S.S.R. 18, 159-61 (1945). 5p.

The crystal structures of the fluorides of the platinum group metals are characterized by cubic and hexagonal packing. These substances are almost cubic rhombohedrons. Cell dimensions and distances are given. (C.W.H.)

6913

NEW CALCULATIONS OF ATOMIC SCATTERING FACTORS. J. Berghuis, IJbertha M. Haanappel, and M. Potters (Mathematical Centre, Amsterdam, Netherlands) and B. O. Loopstra, Caroline H. MacGillavry, and A. L. Veenendaal (Univ. of Amsterdam, Netherlands). Acta Cryst. 8, 478-83(1955) Aug. 10.

Scattering factors for twenty-three atoms have been calculated from Hartree and Hartree–Fock radial wave functions, and the results have been compared with other authors' values. (auth)

6914

A GENERALIZED TREATMENT OF COLD WORK IN POWDER PATTERNS. B. E. Warren (Massachusetts Inst. of Tech., Cambridge). Acta Cryst. 8, 483-6(1955) Aug. 10.

Calculations of the effect of particle-size and cold-work distortion in the broadening of powder-pattern lines have been simplified in several previous treatments by considering the reflections as 00l for orthorhombic axes. By a suitable transformation of variables and axes, it is possible to carry through the calculation for the general hkl reflection for a crystal of any system. The general result obtained is identical to that previously obtained with the simplifying assumptions. The result is expressed in terms of particle-size and distortion Fourier coefficients which are obtained from the experimental peak shapes. (auth)

6915

THE EFFECT OF ATOMS IN FIXED POSITIONS ON THE STATISTICAL TESTS FOR SYMMETRY CENTERS. Robert L. Collin (New England Deaconess Hospital, Boston). Acta Cryst. 8, 499-502(1955) Aug. 10.

The probability distribution of x-ray intensities is altered by the presence of atoms in fixed positions. If these atoms are heavy enough, they will in turn affect the statistical tests that are used to distinguish centric from acentric structures. However, if the positions of these fixed atoms are known, distribution curves can be calculated for both centric and acentric structures. A comparison of these curves with the observed intensity distribution will allow one to infer the presence or absence of a symmetry center. (auth)

6916

THE COPPER FLUORIDES. PART I. X-RAY AND ELECTRON MICROSCOPE EXAMINATION. J. M. Crabtree, C. S. Lees, and K. Little (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 1, 213-17(1955) June.

X-ray diffraction powder photographs have been used to study the fluorides of Cu. Both anhydrous CuF$_2$ and the dihydrate are slowly converted into a green basic fluoride in atmospheric air. In addition, one other basic fluoride has been observed which is unstable in air. No trace of any compound which might be CuF has been obtained, in spite of numerous attempts to make it. Electron diffraction and electron microscope photographs of the corrosion film formed by the action of elementary F on Cu at temperatures between 100 and 500°C have been taken. There is good evidence that the film has a CuF$_2$ structure rapidly changing to the basic fluoride on exposure to air. Electron microscope investigations show that Cu metal can migrate and crystallize as bulk Cu at temperatures as low as 300°C. (auth)

6917

LONG-WAVELENGTH NEUTRON TRANSMISSION AS AN ABSOLUTE METHOD FOR DETERMINING THE CONCENTRATION OF LATTICE DEFECTS IN CRYSTALS. J. J. Antal and R. J. Weiss (Watertown Arsenal, Mass.) and G. J. Dienes (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 99, 1081-5(1955) Aug. 15.

The scattering of long-wavelength neutrons by lattice defects has been used to measure in an absolute way the number of isolated interstitial atoms and vacancies introduced in graphite by reactor irradiation. For an exposure of 1.1×10^{20} neutrons/cm^2 the fraction of displaced atoms was found to be 0.0263. This value is more accurate than present theoretical estimates largely because of uncertainties in exposures. Within this limitation the experimental value is in excellent agreement with that derived from Seitz's theory. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

6918

RATES OF ISOTOPIC REACTIONS BETWEEN METHYL AND HYDROGEN. J. C. Polanyi (National Research Council, Ottawa, Canada). J. Chem. Phys. 23, 1505-13(1955) Aug.

The absolute rate calculations made by Eyring and collaborators on the series of eight isotopic reactions H + H$_2$, etc., fail to provide a real test of their method. Recent data on the eight reactions CH$_3$ + H$_2$, + HD, + DH, + D$_2$; CD$_3$ + H$_2$, + HD, + DH, + D$_2$, provide the first set of independent observations on a series of simple isotopic exchange reactions. Detailed calculation of the entropies of activation give values for the temperature independent factors $A_{calc}^{400°K}$. The energy surface for the reactions is calculated according to the method of Gorin, Kauzmann, Wlater, and Eyring in conformity with the H.L.S.P. treatment of methane. The surface obtained, E = f(ω,r,s), has a

single barrier indicating a classical activation energy of ~ 13 kcal for the forward reaction, in adequate agreement with observed values. The surface described is, therefore, the "best semiempirical surface"; the height of the barrier being regarded as a calibrated, not a predicted, quantity. The surface is accordingly made the basis for a calculation of the total zero-point energies of the eight reactions in their initial states and transition states. Substantial differences in activation energy are predicted. However, rate constants calculated on this basis show no correlation with observation, indicating failure of the method. Using a differently calibrated surface, designed to give the lowest barrier height compatible with a surface free of energy basins, a "symmetrical" surface is obtained for the present series of reactions. Zero-point energies derived from this surface lead to relative rate constants in fair agreement with the eight observed values. This correlation is more properly described as a correlation between A_{calc} and k_{obs}, and is discussed on this basis. (auth)

FLUORINE AND FLUORINE COMPOUNDS

6919

THE ADSORPTION OF CHLORINE TRIFLUORIDE ON POROUS NICKEL FLUORIDE. R. Lynn Farrar, Jr. and Hilton A. Smith (Univ. of Tennessee and Carbide and Carbon Chemicals Co., Oak Ridge). J. Am. Chem. Soc. 77, 4502-5(1955) Sept. 5.

A previous paper has shown that the product of the solid-gas reaction of nickel oxide with gaseous chlorine trifluoride is a porous nickel fluoride. The present paper describes some of the anomalous adsorption properties shown by this powder. After the initial rapid physical adsorption, the sample continued to sorb chlorine trifluoride with a rate which followed the parabolic law. Anomalous values of surface area were obtained as determined by the BET Method. An explanation is presented involving diffusion of the sorbate molecules down the micro-channels between the crystallites of the porous particles. (auth)

GRAPHITE

6920   AERE-RP/R-1618

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
VARIATION OF DIFFUSION LENGTH AND THERMAL NEUTRON ABSORPTION CROSS-SECTION OF GRAPHITE WITH TEMPERATURE. J. E. C. Mills. Mar. 1955. 26p.

The diffusion length and transport mean free path are measured as a function of graphite temperature. The variation of the derived thermal neutron absorption cross section is compared with a 1/v law. (auth)

6921   CRNE-496

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE EFFECT OF PILE IRRADIATION ON THE LINEAR DIMENSIONS OF AGXP GRAPHITE. H. Sheard and N. J. Pattenden. June 1952. 22p. (AECL-213)

Results of experiments which have been carried out on AGXP graphite irradiated in various positions in the NRX pile at Chalk River are presented. The main object of these tests was to provide data which would enable the long term changes in the linear dimensions of the graphite used in the production piles in England to be estimated. (auth)

6922   NAA-SR-1198

North American Aviation, Inc., Downey, Calif.
ACTIVATION TEMPERATURES FOR ANNEALING OF NEUTRON-DAMAGED GRAPHITE AS DETERMINED BY ISOTHERMAL PULSE ANNEALING. Stanley B. Austerman. Sept. 1, 1955. 52p. Contract AT-11-1-GEN-8.

As part of the program to understand the mechanism of annealing behavior in irradiated graphite; specimens of 48 Mwd/ct pile-irradiated graphite were subjected to pulse-annealing, and simultaneous measurements were made of thermal and electrical resistivities and thermo-electric power. Activation temperatures, calculated for annealing at temperatures up to 1850°C showed a continual rise from about 18,000°K at the beginning of low tempera-ture annealing to about 70,000°K at 1400°C annealing tem-perature. Analysis of the annealing rates in conjunction with the calculated activation temperatures show that the annealing processes cannot be explained by simple chemi-cal kinetics, but that a model of overlapping annealing states governed by increasingly higher activation tempera-tures as annealing progresses must be used. In the region of 1200°C the annealing behavior demonstrates a system involving at least two opposing processes. The experi-mental apparatus used for making the measurements and the methods of analysis are described. Tables give. com-plete annealing data. (auth)

6923

ATOMIC HEAT OF GRAPHITE BETWEEN 1 AND 20°K. P. H. Keesom and N. Pearlman (Purdue Univ., West Lafayette, Ind.). Phys. Rev. 99, 1119-24(1955) Aug. 15.

The atomic heat of pure artificial polycrystalline graphite has been measured between 1 and 4°K and 10 and 20°K. Pre-cautions were taken to ensure that no error was introduced by gas adsorbed on the graphite. Below 2°K the atomic heat can be represented as the sum of a term proportional to T^3 arising from low-frequency lattice waves and a term pro-portional to T due to electrons: $C = 0.0325T^3 + 0.031T$ millijoules/mole degree. Between 2.25°K and 4.5°K, $C = 0.115T^2 + 0.031T - 0.237$ millijoules/mole degree; between 10 and 20°K, $C = 0.208T^2 - 6.8$ millijoules/mole degree. (auth)

6924

MAGNETIC SUSCEPTIBILITY AND FREE ENERGY OF GRAPHITE BROMIDE. G. R. Hennig (Argonne National Lab., Lemont, Ill.) and J. D. McClelland (North American Aviation, Inc., Downey, Calif.). J. Chem. Phys. 23, 1431-5 (1955) Aug.

The magnetic susceptibility of graphite bromide residue compounds has been measured by a Faraday method. The addition of bromine decreased the diamagnetism of graphite. Fair agreement was obtained between the measured diamagnetism and values calculated by assuming an un-distorted graphite band structure depleted in electrons due to the dissociation and ionization of two out of eleven bromine molecules. It has also been shown that the transfer of electrons from the graphite bands to bromine can account for the observed pressure dependence of the graphite bromine equilibrium. (auth)

MOLECULAR STRUCTURE

6925   NAA-SR-1357

North American Aviation, Inc., Downey, Calif.
MOLECULAR WEIGHT DETERMINATION OF THE META-

POLYPHENYLS BY MEASURING THE ABSORBANCE.
Louis Silverman and William Houk. Sept. 1, 1955. 10p.
Contract AT-11-1-GEN-8.

At the wave length of maximum absorbance, the absorbance of the meta-polyphenyls in the ultraviolet range decreases with increasing molecular weight, and the values are directly related, graphically. In this manner, the absorbance of the unknown is obtained and the molecular weight is read from the standard curve. (auth)

RADIATION EFFECTS

6926   KAPL-1366
Knolls Atomic Power Lab., Schenectady, N. Y.
INFLUENCE OF NEUTRON BOMBARDMENT ON COLD-WORKED AND CARBURIZED IRON SINGLE CRYSTALS.
F. W. Kunz. June 23, 1955. 29p. Contract W-31-109-Eng-52.

Carburized and cold-worked single crystals of iron were irradiated at room temperature to a total integrated flux of 10^{18} nvt to determine the effect of neutron irradiation on the mechanical properties of iron cyrstals hardened by other means prior to irradiation. The results presented show that the effect of solute atom hardening plus irradiation hardening can be described as an additive process; in contrast, the hardening effect of irradiation decreases with increasing amounts of cold work. The data have been interpreted on the basis of defect agglomerates of vacancies and interstitial atoms produced during collision events. (auth)

6927

THE RADIATION-INDUCED OXIDATION OF FERROUS ION.
Tyson Rigg, Gabriel Stein, and Joseph Weiss (Univ. of Durham, England). J. Am. Chem. Soc. 77, 4526-7(1955) Sept. 5.

6928

DIRECT ACTION OF COBALT GAMMA RADIATION ON NITRATE ION IN AQUEOUS SOLUTION. Thomas J. Sworski (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 77, 4689-90(1955) Sept. 5.

6929

DECOMPOSITION OF OXALIC ACID IN AERATED AQUEOUS SOLUTION UNDER THE INFLUENCE OF VERY HIGH γ DOSES. Ivan Draganic. J. chim. phys. 52, 511(1955) June. (In French)

Various γ radiations were used to irradiate oxalic acid in aerated aqueous solutions. Results indicate that it might be possible to use the radiolysis of aqueous oxalic acid as a dosimeter for strong doses where the usual dosimeters are useless. (B.J.H.)

6930

EFFECT OF THE β RADIATION OF RADIOACTIVE PHOSPHORUS ISOTOPE (P^{32}) ON AMINO ACIDS. M. A. Khenokh and E. M. Lapinskaya (Lesgaft State Natural Science Inst.). Doklady Akad. Nauk S.S.S.R. 102, 993-6(1955) June 11. (In Russian)

Data are presented on NH_3 evolution in P^{32}-irradiated aqueous solutions of glycine, alanine, and leucine under various conditions of hydrolysis and in the presence of glucose or maltose. (G.Y.)

SEPARATION PROCEDURES

6931   NP-5742
Wisconsin. Univ., Madison.
THE SYSTEMS FORMED BY ZIRCONIUM AND HAFNIUM TETRACHLORIDE WITH ACETONITRILE AND ISOAMYL ETHER. Technical Report VII [on] CHEMISTRY OF HAFNIUM AND ZIRCONIUM. Edwin M. Larsen and LaVerne E. Trevorrow. Aug. 1955. 13p. Project No. NR-052-177. Contract N7-onr-28504, Task Order 4.

The system zirconium (hafnium) tetrachloride, isoamyl ether, and acetonitrile shows a binodal curve which is truncated by a line representing equilibrium of a solid phase, $MCl_4 \cdot 2CH_3CN$ with two liquid phases of varying compositions. The compound $MCl_4 \cdot 2$-isoamyl ether was observed only in equilibrium with a saturated solution of the pure solvent. Only a slight difference in the distribution of zirconium and hafnium between the two phases was noted. The solutes concentrated in the acetonitrile phase, and the hafnium did so to a slightly greater extent than did the zirconium. The maximum separation factor was Hf/Zr = 1.8. (auth)

6932   NP-5743
Wisconsin. Univ., Madison.
THE ANHYDROUS REDUCED HALIDES OF ZIRCONIUM AND HAFNIUM. Technical Report IX [on] CHEMISTRY OF HAFNIUM AND ZIRCONIUM. Edwin M. Larsen and James J. Leddy. Aug. 1955. 22p. Project No. NR-052-177. Contract N7-onr-28504, Task Order 4.

A study was made of reactions of the type M(s) + $3MX_4$(g) = $4MX_3$(s), where M refers to zirconium or hafnium, and X refers to F, Cl, Br, or I. A pseudo-equilibrium position, found by plotting the extent of reaction versus reaction time, occurred after the reaction had proceeded for 36 to 48 hr. It shifted in favor of the reaction product with increasing temperature, in the range 200 to 700°, and/or increasing pressure, in the range five to fifteen atm. The ease of reduction of MX_4 increased considerably from chloride to iodide, and very slightly from hafnium to zirconium. No reaction was found to occur under the above conditions between MF_4 and M. The disproportionation reactions were followed both macroscopically and by an x-ray method. The rates of disproportionation appeared to be appreciable only at temperatures above 450°. X-ray powder patterns of pure MX_3 samples were obtained. The crystal symmetry of the MX_3s was found to be hexagonal, the unit cell edges being a_0 = 6.31 A and c_0 = 19.3 A for MCl_3; a_0 = 6.71 A and c_0 = 19.0 A for MBr_3; a_0 = 7.17 A and c_0 = 19.7 A for MI_3. (auth)

6933   NP-5744
Wisconsin. Univ., Madison.
ALIZARIN SULFONATE COMPLEXES OF ZIRCONIUM AND HAFNIUM. Technical Report X [on] CHEMISTRY OF HAFNIUM AND ZIRCONIUM. Edwin M. Larsen and Stanley T. Hirozawa. Aug. 1955. 18p. Project No. NR-052-177. Contract N7 onr-28504, Task Order 4.

Amperometric titrations of alizarin S with $10^{-4}M$ zirconium and hafnium solutions in 0.1M perchloric acid show that the insoluble compound initially formed redissolves upon the addition of excess metal ion. The stoichiometry at the endpoints for these two species depends upon the age of the metal ion solution. The mole ratio of zirconium to alizarin in S at the first end point increased from 0.8 to 1 as the solution aged, and for

hafnium from 0.81 to 0.88. For the second endpoint, the ratio ranged from 1.2 to 1.75 for the zirconium solutions, and remained constant at 1.22 for the hafnium solutions. The ultraviolet and visible absorption spectra of aqueous solutions of these complexes are the same. From the amperometric and spectral data, it is concluded that a metal ion is chelated by a quinoid oxygen and the alpha phenolic oxygen. (auth)

6934   NP-5745

Wisconsin. Univ., Madison.

THE CHEMISTRY OF ZIRCONIUM AND HAFNIUM. Final Report [covering the period February 1, 1948 to August 31, 1955]. Edwin M. Larsen. Aug. 1955. 21p. Project No. NR-052-177. Contract N7 onr-28504, Task Order 4.

Investigations of the following aspects of Zr and Hf chemistry are summarized: aqueous chemistry, including pH of precipitation, extraction with various β diketones, behavior with cation exchange resins, and the polarographic investigation of the alizarin S-metal ion reaction; anhydrous chemistry, the anhydrous tetrahalides as Lewis acids, the nature of addition compounds with the tetrahalides, their distribution between two immiscible Lewis bases, and the reduced halides of these elements. In addition, the preparation and properties of the solid chelate compounds of certain β diketones were investigated. (auth)

6935

ANION-EXCHANGE STUDIES. XVIII. GERMANIUM AND ARSENIC IN HCl SOLUTIONS. Frederick Nelson and Kurt A. Kraus (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 77, 4508-9(1955) Sept. 5.

The anion-exchange behavior of Ge(IV), As(III) and As(V) in hydrochloric acid solutions was studied with a strong base quaternary amine anion-exchange resin. Both Ge(IV) and As(III) show little adsorption at low $\underline{M}$ HCl and rapidly increasing adsorption with increasing $\underline{M}$ HCl above ca. 5 $\underline{M}$ HCl. Adsorption of As(V) was low throughout the HCl concentration range studied (0.1 to 12 $\underline{M}$). Application of these data to separations is discussed. (auth)

SPECTROSCOPY

6936

INFRARED SPECTRA AND STRUCTURES OF CYCLOPENTADIENYL-CARBON MONOXIDE COMPOUNDS OF V, Mn, Fe, Co, Mo, AND W. F. A. Cotton, A. D. Liehr, and G. Wilkinson (Harvard Univ., Cambridge, Mass.). J. Inorg. and Nuclear Chem. 1, 175-86(1955) June.

The infrared absorption spectra in the C—O stretching region of mono- and binuclear transition metal cyclopentadienyl-carbon monoxide compounds are presented. The structures of the molecules are discussed and it is shown that the spectra may be interpreted by consideration of the local symmetry of the CO groups only. For the binuclear Mo and W compounds, the spectra are best explained by puckered five- and six-membered cyclic CO systems, respectively. For Fe compound a single bridging CO group is postulated. The compounds studied are $C_5H_5V(CO)_4$, $C_5H_5Mn(CO)_3$, $C_5H_5Co(CO)_2$, $C_5H_5Mo(CO)_3MoC_5H_5$, $C_5H_5W(CO)_6WC_5H_5$, and $(C_5H_5Fe)_2(CO)_4$. (auth)

SYNTHESES

6937

CYCLOPENTADIENYL-CARBON MONOXIDE AND RE-

LATED COMPOUNDS OF SOME TRANSITIONAL METALS. T. S. Piper, F. A. Cotton, and G. Wilkinson (Harvard Univ., Cambridge, Mass.). J. Inorg. and Nuclear Chem. 1, 165-74(1955) June.

The preparation of cyclopentadienyl-carbon monoxide compounds of Mn, Fe and Co, and of cyclopentadienylnitric oxide-nickel is described. The compounds $(C_5H_5Fe)_2(CO)_4$ and $C_5H_5Co(CO)_2$ were prepared by the direct reaction of the metal carbonyl with dicyclopentadiene and cyclopentadiene, respectively. $C_5H_5Mn(CO)_3$ was prepared by the action of CO on the reaction mixture of sodium cyclopentadienide with $MnBr_2$, and C_5H_5NiNO by the reaction of NO with bis-cyclopentadienyl-nickel. The cation $[C_5H_5Mn(CO)_2NO]^+$ was isolated as the chloroplatinate from the reaction of $C_5H_5Mn(CO)_3$ with N_2O in ethanol. The compounds $C_5H_5Fe(CO_2Cl$ and $C_5H_5Fe(CO)_2CN$ have been prepared from $(C_5H_5Fe)_2(CO)_4$. The configurations and structures of the compounds are discussed briefly. (auth)

TRACER APPLICATIONS

6938

THE SOURCE AND STATE OF THE HYDROXYLSINE OF COLLAGEN. F. Marott Sinex and Donald D. Van Slyke (Brookhaven National Lab., Upton, N. Y.). J. Biol. Chem. 216, 245-50(1955) Sept.

In order to find whether hydroxylysine is formed from lysine in the animal body, young rats were fed for 3 weeks L-lysine uniformly labeled with C^{14}. The rats were then sacrificed, and gelatin was prepared from the skin collagen and hydrolyzed. The basic amino acids were separated from the hydrolysate by precipitation with phosphotungstic acid and then from each other by means of a Dowex 50 ion exchange column. The C^{14} specific activity was the same in the hydroxylysine as in the lysine, and in both of the amino acids the specific activity was the same in the carboxyl group as in the rest of the 6-carbon chain, indicating the probability that the uniform C^{14} labeling of the fed lysine was retained. The results indicate that hydroxylysine in the body is formed from lysine. The approximate equality of C^{14} activity in both amino acids indicated the probability that but little hydroxylysine is formed from other sources. Dog tail tendon contained only a small fraction of the amount of phosphorus that would be present if the hydroxyl group of the hydroxylysine were esterified with phosphoric acid. (auth)

6939

ON THE ABSENCE OF ISOTOPE EFFECTS IN THE EXCHANGE REACTION BETWEEN CARBONATE ION AND THE CARBONATO-TETRAMMINO COBALTO COMPLEX ION. E. Saito and B. Lazard (Commissariat à l'Énergie Atomique, Paris, France). J. Inorg. and Nuclear Chem. 1, 218-27(1955) June. (In French)

Verification of isotope effects in the exchange of carbonate ion with the carbonato tetrammino cobalt complex ion was sought. Stranks and Harris, using C^{14} labeling, have found a very strong effect in this reaction. Normal carbon was used, as well as samples labeled, separately or together, with C^{13} and C^{14}. Apparent contradictions can be reconciled by the assumption that the reaction shows no true isotopic effect, and that the complex ion preparation contains a non-exchanging impurity. While varied indirect arguments (in particular the polarographic evidence), and the absence of any effect with normal carbon preparations, strongly support this assumption, attempts to identify the impurity

have failed so far. Results agree with the fact that no isotope effect was detected in the case of cobalti-carbonato-bisethylenediamine, neither with C^{13} (Yankwich and McNamara) nor with C^{14} (this investigation). (auth)

TRITIUM AND TRITIUM COMPOUNDS

6940

TRITIUM-CARBON MONOXIDE REACTION. David L. Douglas (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Chem. Phys. 23, 1558-9(1955) Aug.

The radiation-induced reaction between H^3 and CO has been studied. Formaldehyde was the principal reaction product found. Water, carbon dioxide, acetaldehyde, glycol, and glyoxal were also found. This reaction may be helpful in the preparation of T_2CO and other tritium-labeled aldehydes and ketones. (C.W.H.)

URANIUM AND URANIUM COMPOUNDS

6941   A-4120

National Bureau of Standards, Washington, D. C. SPECIFIC HEAT, ENTHALPY AND ENTROPY OF UCl_3 FROM 0° TO 727°C. D. C. Ginnings and R. J. Corruccini. [194?]. Decl. July 16, 1954. 5p.

6942   DOW-134

Dow Chemical Co. Western Div., Pittsburg, Calif. PROGRESS REPORT [FOR[JULY−AUGUST 1955. Research Dept. R. H. Bailes. Sept. 1, 1955. 29p. Contract AT-30-1-GEN-236.

Studies of the recovery of U from plateau ores and from Florida leached zone material by solvent extraction of aqueous leach liquors with organic phosphate solutions and from plateau ores by non-aqueous leaching with organic leach solutions are presented. (For preceding period see DOW-132.) (auth)

6943   AEC-tr-2227

FLUORITE PHASES IN THE SYSTEM OF PRASEODYMIUM OXIDE−URANIUM OXIDE. F. Hund and U. Peetz. Translated from Z. Elektrochem. 56, 223-8(1952). 9p. Available from Associated Technical Services (Trans. 76G6G), East Orange, N. J.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 6-5573.

6944

COMPOUNDS OF URANIUM WITH THE TRANSITION METALS OF THE SECOND AND THIRD LONG PERIODS. T. J. Heal and G. I. Williams (Fulmer Research Inst., Stoke Poges, England). Acta Cryst. 8, 494-8(1955) Aug. 10.

The crystal structures of the intermetallic compounds, UOs_2, UIr_2, UPd_3, URu_3, and UPt_3, have been determined by x-ray-diffraction analysis. (C.W.H.)

ENGINEERING

6945   ANL-5453

Argonne National Lab., Lemont, Ill. EFFICIENCY STUDIES OF A HIGH-EFFICIENCY, HIGH-TEMPERATURE FILTER AGAINST FRESHLY GENER-

ATED URANIUM OXIDE FUME. Edward W. Conners, Jr. and Donald P. O'Neil. June 1954. 19p. Contract W-31-109-eng-38.

Results of an investigation of the efficiency of a high-efficiency high-temperature filter against freshly generated uranium oxide are given. Efficiencies ranged from 95.5% to 99.5% against an aerosol having a count median diameter of 0.12μ and a geometric standard deviation of 3.29. Factors affecting the performance of this filter and the effect on permissible stack emissions are discussed. (auth)

6946   ANL-5462

Argonne National Lab., Lemont, Ill. REACTOR ENGINEERING DIVISION UNCLASSIFIED QUARTERLY REPORT [FOR] JANUARY 1, 1955 THROUGH MARCH 31, 1955. Apr. 15, 1955. 23p. Contract W-31-109-Eng-38.

Calculations were made to study the effect of changing either height or width of a boiling channel on the power density of the channel. For a given value of average steam volume fraction, it was found that the total power output of a natural circulation boiling channel is independent of channel height and that the power density increases slightly with increased channel spacing. Experiments to determine the effect of preferential void distribution and geometry on void measurements in channels are described, and results are presented. Thermenol, and Al−Fe−Mo alloy, has been corrosion tested in 500°F degassed water for a total of 3,452 hr. The weight change over this period was essentially zero, and there was no evidence of pitting or general attack. A series of tests have been completed on a number of wound fiber filters and carbon-coated well-membrane filters to evaluate the efficiency of these types of filters for the removal of finely divided magnetite. The carbon-coated filters showed very high filtering efficiency, and cotton fibers were found to be more effective than synthetic fibers. Results are summarized in graphical form. (M.P.G.)

6947   EES-040038F(7)

Naval Engineering Experiment Station, Annapolis. EXAMINATION OF SPECIAL TUBE JOINTS IN A STAINLESS STEEL AUXILIARY MINE-SWEEPER BOILER. W. Lee Williams. Oct. 1, 1954. 22p. Project NS-013-120.

Tube joints of six different designs were exposed to a 1000-hour steaming period in a stainless steel auxiliary mine-sweeper boiler. One tube of each design then was examined with the object of determining the effectiveness of the design in eliminating waterside tube-to-header crevices and the stress-corrosion cracking that has been associated with such crevices. The examination was made by macroscopic and microscopic inspection. None of the joint designs effectively eliminated the crevices, with one exception: a joint welded from both sides of the header. This one joint was the only one which did not develop waterside stress-corrosion cracks. (auth)

6948   EES-040038F(9)

Naval Engineering Experiment Station, Annapolis. EXAMINATION OF CLAYTON TYPE AUXILIARY BOILER FOR AM 421 CLASS MINE SWEEPERS. W. Lee Williams. Oct. 1, 1954. 20p. Project No. NS-013-120.

An examination was made of selected components from a Clayton type auxiliary boiler made entirely of nonmagnetic materials. The boiler had been steamed on trial for 1000 hours. The parts examined consisted of tubes, water baffle,

support clips, and coil discharge fitting. Although some deterioration had occurred, the general condition of the boiler was good. Certain suggestions were proposed for improving the performance of the materials in subsequent boilers of this type. (auth)

6949 PRL-5.15

Pennsylvania State Univ., University Park. Petroleum Refining Lab.

FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS. Quarterly Report for April, May, and June 1955. June 30, 1955. 91p. Contract AF33(616)2851, Task Nos. 73313, 73314, and 73300; Quarterly Report No. 2.

(For preceding period see PRL-5.14)

6950

A METHOD FOR THE GRAPHICAL CALCULATION OF THE NUMBER OF THEORETICAL PLATES IN AN ELECTROLYTIC PLANT WITH EXCHANGE TOWERS FOR THE PRODUCTION OF HEAVY WATER. D. Dinelli. Energia nucleare (Milan) 2, 426-33(1955) Aug. 15. (In Italian)

The fundamental equations for a water electrolysis plant with exchange reactions towers (the exchange reactions occur between steam and hydrogen) are obtained in the general case of any deuterium concentration. On the basis of these equations it is possible to carry out a simple graphical method for the determination of the number of theoretical plates of the columns in order to get a given enrichment. The graphical method is described both for the cases of low and of medium concentrations. (auth)

HEAT TRANSFER AND FLUID FLOW

6951 AD-52022

California. Univ., Berkeley. Inst. of Engineering Research.

HEAT TRANSFER TO LAMINAR AND TURBULENT BOUNDARY LAYERS WITH CONSTANT AND VARIABLE FREE STREAM VELOCITY. Report No. 3 on Heat Transfer to Boundary Layers with Variable Free Stream Velocity. R. A. Seban and D. Doughty. Aug. 1954. 37p. Contract AF33(616)-348.

Experimental results are reported for the heat transfer to a two dimensional, variable velocity air flow over the surface of a uniformly heated plate. Layers, formed under relatively constant velocity conditions, were subjected to an intense acceleration, followed by a more gradual deceleration, and both laminar and turbulent flow occurred, the latter being produced by roughness elements located at the leading edge of the plate. The primary function of results of this type is for the evaluation of methods of predicting local heat transfer in such flows. One set of such comparisons is made, with a slightly modified theory being presented for laminar flow and a new theory for turbulent flow. Good results are obtained generally, through the poorer agreement for turbulent flow indicates further theoretical development to be required. Results for constant free stream velocity, for the same model, are also presented. These aid in establishing the performance of the model and also supplement the yet small number of results available for this basic flow condition. (auth)

6952 LA-1912

Los Alamos Scientific Lab., N. Mex.

THE NUMERICAL TREATMENT OF SIMPLE HYDRO-DYNAMIC SHOCKS USING THE VON NEUMANN-RICHTMYER METHOD. Charles F. Sprague, III. May 1955. 80p. Contract W-7405-eng-36.

The differential equations describing the flow of compressible fluids are derived and shown to be discontinuous under some circumstances. These discontinuities are shown to be determinable by the introduction of "shock discontinuities" or by the introduction of a pseudo-viscosity term as developed by Von Neumann and Richtmyer. The differential equations of compressible fluid flow are developed completely, and the equation of state of an ideal gas is discussed. The effect of both small and large disturbances on fluid flow is shown. The Von Neumann-Richtmyer method is discussed and difference equations formulated. The validity of the method of approximations is demonstrated by comparing the solutions of the differential equations and difference equations. (D.E.B.)

6953 NP-5751

Mine Safety Appliances Co., Callery, Penna.

FINAL REPORT ON THE 1000 KW AIR COOLED, LIQUID METAL HEAT TRANSFER LOOP. R. A. Tidball, F. L. Mangold, S. N. Tower, and T. A. Ciarlariello. Aug. 16, 1955. 129p. Project NR-031-364. Contracts N9onr-85801 and NObs-65426, Technical Report No. 39.

A 1000-Kw liquid metal heat transfer system has been designed and operated at 1500°F. The system used sodium—potassium alloy to transmit heat from a gas fired furnace to an intermediate heat exchanger. Sodium was used to transmit the heat from the intermediate heat exchanger to an air heat sink. The maximum heat load on the system was 3,500,000 Btu/hr with the NaK temperature at the heater outlet of 1500°F. (See also NP-5491.) (auth)

6954 AEC-tr-2211

FLOW OF FLUIDS IN CURVED PIPES. M. Adler. Translated from Z. angew. Math. u. Mechan. 14, 257-76(1934). 39p.

The law of resistance obtained by an approximation integration of the Navier-Stokes equation of motion for laminar flow which is dependent upon the parameter $Re(a/R)^{1/2}$ (Re = Reynolds number, a/R = ratio of curvature) is suitable only for very small Reynolds numbers and curvatures. In order to obtain a relation for resistance in the undercritical region with large Reynolds numbers, a calculation was performed based on Prandtl's theory of the boundary layer. Solutions of differential equations obtained by an analysis of impulses at the boundary layer result in an asymptotic law for the resistance which agrees well with results determined experimentally at the boundary. In this law a relation of the parameter $Re(a/R)^{1/2}$ is obtained also. Resistance measurements extend into the turbulent region. Furthermore, the distribution of velocities across the cross section of the tube were determined for various ratios of curvature with laminar and turbulent flow. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

6955 YD-54-21

Sylvania Electric Products Inc. Physics Labs., Bayside, N. Y.

A SIMPLIFIED AND RAPID PROCEDURE FOR MEASURING MEAN PARTICLE DIAMETER AND SURFACE

AREA OF FINE POWDERS BY GAS ADSORPTION. D. T. Palumbo and F. M. Starkweather. Sept. 24, 1954. 21p. Project Nos. 231-4627 and [231]-1740. Contract NObsr-5359.

With this is bound, with separate paging, supplement: Sylvania Electric Products Inc. Chemistry Lab., Bayside, N. Y. THE SYLVANIA GAS ADSORPTION PARTICLE SIZE APPARATUS. Engineering Memorandum 6509.34. D. J. Bracco. June 7, 1955. 6p.

A modification of the standard Brunauer-Emmett-Teller gas adsorption technique for the determination of surface areas of fine powders is discussed. The data show that values within 10% of those by the standard method are obtained for triple carbonates, zinc sulfide, cadmium sulfide, and zinc silicate. The value for surface area obtained by the modified procedure can be made to approach the value by the standard procedure if the time of outgassing the sample is increased. Values of the mean particle diameter can be calculated from the measured surface areas by assuming spherical particles. Typical calculations are given. (auth)

CERAMICS AND REFRACTORIES

6956   WADC-TR-53-5
New York. State Univ. Coll. of Ceramics, Alfred. INVESTIGATION OF THE BONDING OF SILICON CARBIDE BY METALS. [Summary of Work During the Period January 11, 1952 through January 11, 1953]. Richard A. Alliegro and James R. Tinklepaugh. Jan. 1953. 33p. Contract AF33(038)-16190-2. (AD-7111)

A study of the bonding of silicon carbide by various metals was conducted using several techniques: reaction products from thermodynamic data; wettability of silicon carbide by metals; reaction products of silicon carbide and metals by metallographic reaction zone studies and x-ray-diffraction identification; examination of hot-pressed metal—carbide parts. It was found that: silicon carbide alone could be hot pressed to densities ranging from 85 to 95% of the theoretical density; iron and a Cr—Mo alloy could be used to bond silicon carbide; silicon carbide could be infiltrated by the Cr—Mo alloy; pressures as high as 12,000 psi at 2230°C and 16,000 psi at 1870°C could be used in hot pressing if hot-pressed silicon carbide was used for the die plunger. (auth)

6957

INVESTIGATION OF CERTAIN REGULARITIES IN THE FORMATION OF ALLOYS OF ISOMORPHIC BORIDES. G. V. Samsonov and V. S. Neshpor (Moscow Inst. of Nonferrous Metals and Gold). Zhur. Fiz. Khim. 29, 839-45(1955) May. (In Russian)

The diffusion process in the high-temperature formation of TiB_2—NbB_2 systems of various compositions and the microstructures, microhardnesses, and electrical conductivity of such systems have been investigated. (G.Y.)

CORROSION

6958   NP-5740
Mine Safety Appliances Co., Callery, Penna. INHIBITORS TO TRANSFER OF RADIOACTIVE STAINLESS STEEL CONSTITUENTS IN SODIUM. J. W. Mausteller and S. J. Rodgers. Aug. 24, 1955. 19p.

Contract NObs-65426, Technical Report No. 41.

The effect of additives on the inhibition of mass transfer of radioactive stainless steel components in a sodium system has been studied. Barium was the most effective inhibitor with an inhibition effect of 17 (inhibitor effectiveness = gross count on control/gross count on sample); Sr, Ca, Ti, Sb, and Mg, followed in that order. The primary inhibitor mechanism appears to be reduction of oxygen content of the Na. Examination of wall surfaces points to a barrier coating by the inhibitor as a secondary mechanism. Ta^{182} and Fe^{59} constituted the major activity deposited on the pipe walls. Analysis of the radioactive species deposited in titanium and antimony inhibited systems showed that Ta^{182} transfer was generally inhibited to a greater extent than Fe^{59}. Co^{60} transfer was little affected. (auth)

6959   AEC-tr-2225
A NEW METHOD OF SEPARATING ANODIC OXIDATION FILMS FORMED ON THE SURFACE OF ALUMINUM AND ITS ALLOYS. Paul Lacombe and Louis Beaujard. Translated by K. S. Bevis from Métaux, corrosion, usure 20, 43-7(1945). 9p.

An electrochemical method for the separation of aluminum oxide films from the surface of Al and Al alloys is presented. It is based on the anodic dissolution of the underlying metal directly in contact with the oxide. Comparisons with other methods are included. (C.W.H.)

6960

VALVES FOR CORROSIVE FLUIDS. E. G. Holmberg (Alloy Steel Products Co., Linden, N. J.). Corrosion 11, 406t-14t(1955) Sept.

Methods are given whereby valves for control of corrosive fluids may be selected. Means of selecting suitable alloys are described, including laboratory and in-service tests, analogies of resistance through consideration of minor constituents and experience in actual plant service. Case histories of valve failures from corrosion are given and analyzed. Detailed consideration is given to the design of valves and their component parts with recommendations concerning approved designs suitable for certain classes of service. The several kinds of flanged connections are described and their good and bad features analyzed. Details of internal construction that should be taken into account are itemized. Several valve standards are considered with respect to their applicability to corrosive services. (auth)

6961

KINETICS AND MECHANISM OF THE OXIDATION OF MOLYBDENUM. M. Simnad and Aija Spilners (Carnegie Inst. of Tech., Pittsburgh). J. Metals 7, 1011-16(1955) Sept.

The rates of formation of the different oxides on molybdenum in pure oxygen at 1 atm. pressure have been determined in the temperature range 500 to 770°C. The rate of vaporization of MoO_3 is linear with time, and the energy of activation for its vaporization is 53,000 cal per mol below 650°C and 89,600 cal per mol at temperatures above 650°C. The ratio $MoO_{3(vaporizing)}/MoO_{3(surface)}$ increases in a complicated manner with time and temperature. There is a maximum in the total rate of oxidation at 600°C. At temperatures below 600°C, an activation energy of 48,900 cal per mol for the formation of total MoO_3 on molybdenum has been evaluated. The suboxide MoO_3 does not increase beyond a very small critical thickness. At temperatures above 725° catastrophic oxidation of an autocatalytic nature was en-

countered. Pronounced pitting of the metal was found to occur in the temperature range 550 to 650°C. Marker movement experiments indicate that the oxides on molybdenum grow almost entirely by diffusion of oxygen anions. (auth)

GEOLOGY AND MINERALOGY

6962   CEA-345

France. Commissariat à l'Energie Atomique, Paris. GÉOCHIMIE ET PROSPECTION MINIÈRE. [Geochemistry and Ore Prospecting]. R. Le Caignec. 1954. 33p.

Applied geochemistry is a new technique which helps the geologist in detecting ore deposits. Some deposits, even when they are covered with rather thick surface structures, form around them zones where the infinitesimal content of some elements of soils or waters is notably different. These "anomalies" may be contemporaneous to the deposit structure (primary dispersion) or may have occurred later (secondary dispersion). Various factors rule these anomalies: ore stability, soil homogeneity, water conditions, topography, vegetation, etc. Applied geochemistry is in fact the study of analysis techniques of metal traces in soils as well as the geological interpretation of observed anomalies. This report gives practical data on sampling methods, yields, costs and also on special problems of uranium geochemistry. (auth)

6963   RME-2013(Pt.1,Rev.)

Division of Raw Materials, AEC. SUMMARY REPORT OF RECONNAISSANCE AND EXPLORATION FOR URANIUM DEPOSITS IN NORTHERN NEVADA. Part 1, Revised. H. Clyde Davis. July 1954. 23p.

Reconnaissance in northern Nevada, that portion of the State north of the Mt. Diablo Base Line, was conducted during the period from March to November, 1953. Eight areas of significant uranium occurrences were reported prior to the initiation of this project. Ten new occurrences were reported and investigated during the period of reconnaissance for this report. Very little exploitation has been accomplished at most of the showings and only one has yielded commercial production. Pitchblende is known at four localities—Long Lease mine, East Walker River area, Stalin's Present prospect, and Cottonwood Canyon (?) area. Metatorbernite and torbernite are the most common secondary minerals occurring at East Walker River, Majuba Hills, Early Day and Truckee Canyon area. Other uranium minerals identified were carnotite, tyuyamunite, autunite, gummite, uranophane, kasolite, and phosphyargite. One deposit contains thorium in the form of monazite and another, rare earths in allanite. The western half of the state appears more favorable for uranium mineralization than the eastern part. (auth)

6964   RME-4066

Division of Raw Materials, AEC. GEOLOGY OF THE SEVEN MILE CANYON URANIUM DEPOSITS, GRAND COUNTY, UTAH. Robert F. Droullard and Everett E. Jones. June 1955. 18p.

Uranium deposits in the Seven Mile Canyon area are concentrated along the contact of the Chinle and Moenkopi formations of Triassic age. The Shinarump conglomerate is absent except for isolated lenses. The deposits are associated with three types of host rock; a gray sandy mudstone carries the most persistent ore while the lime-

stone conglomerate and interbedded sandstone, limestone, mudstone types, though usually much higher in uranium content, are discontinuous and have a high lime content. (auth)

6965   AERE-Lib/Trans-487

LOSS OF ELEMENTS, AND ERRORS IN AGE MEASUREMENTS. J. M. Lopez de Azcona. Translated by J. B. Sykes from Anales real soc. españ. fis. y quim. Madrid **44B**, 571-6(1948). 3p.

Sources of error in age determinations by radioactive methods are discussed. Apparent discrepancies in past measurements are attributed to emanation losses which increase with increasing lifetime of the emanation. A graph for the correction of this loss is included. (D.E.B.)

6966

AGE OF URANINITES FROM DIMENSIONS OF THEIR UNIT CELLS. S. A. Hiemstra (Geological Survey, Pretoria, S. Africa). Nature **176**, 405(1955) Aug. 27.

The suggestion that estimations of the age of uraninites can be made from the crystal lattice shrinkage due to the presence of decay product tetravalent Pb is discussed. (D.E.B.)

6967

INVESTIGATION FOR RADIOACTIVE DEPOSITS IN SOUTHEASTERN ALASKA. Walter S. West and Paul D. Benson. U. S. Geol. Survey Bull. 1024-B, 1955. 34p. plus 3 illus. $0.55 (GPO)

A radioactivity investigation during 1949 in the Hyder district, southeastern Alaska, revealed that radioactive material is widely distributed on the property of the Mountain View Gold Mining Company. However, no uranium deposits of commercial value were found in the small part of the district covered by this investigation. Above-normal radioactivity was detected at a number of localities on the Mountain View property, but the source could not be determined at all sites. The most highly radioactive unconcentrated vein sample collected in 1949 contained 0.049 percent equivalent uranium, and the most intensely radioactive vein-material concentrate (specific gravity greater than 2.89) contained 0.398 percent equivalent uranium. Both samples were from the Skookum tunnel on the Mountain View property. The radioactive material on the properties investigated in the Hyder district appears to be chiefly uranium, which occurs in an unidentified highly radioactive opaque mineral and in trace amounts in the sulfides of the vein deposits. Some of the radioactive material, however, is disseminated in the igneous rocks of the district and, to a minor extent, occurs as thin secondary coatings on fracture surfaces in veins and rocks. In addition to the unidentified highly radioactive opaque mineral and 2 distinct secondary uranium-bearing minerals, 16 minerals were found to contain uranium in minor amounts. Investigations for radioactive deposits during 1949 in the vicinities of Ketchikan, Goddard Hot Springs, Chichagof, Funter Bay, and Juneau, southeastern Alaska, revealed no significant concentrations of radioactive materials. Concentrates from stream gravels and disintegrated bedrock near Goddard Hot Springs were the most radioactive samples collected in these areas. They contain from 0.012 to 0.016 percent equivalent uranium. As the chief radioactive mineral in these concentrates is allanite, most of the radioactivity is ascribed to thorium. (auth)

6968

THE URANIUM DEPOSITS OF THE UNITED STATES.

MINERAL INVESTIGATIONS RESOURCE APPRAISALS MAP
MR 2. Robert W. Schnabel, comp. Washington, U. S.
Geological Survey, 1955. $0.50.

A map showing the location of the more important U
deposits in the U. S. that have been discovered to June,
1955 by private individuals, corporations, and government
agencies is presented. (J.E.D.)

5969

PRELIMINARY GEOLOGIC MAP OF THE NATURITA NW
QUADRANGLE, COLORADO. MINERAL INVESTIGATIONS
FIELD STUDIES MAP MF 30. Fred W. Cater, Jr.
Washington, U. S. Geological Survey, 1955. $0.25.

6970

PHOTOGEOLOGIC MAP OF THE BLUFF-4 QUADRANGLE,
SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC
INVESTIGATIONS MAP I-59. J. N. Platt. Washington,
U. S. Geological Survey, 1955. $0.50.

6971

PHOTOGEOLOGIC MAP OF THE ELK RIDGE-16 QUAD-
RANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS
GEOLOGIC INVESTIGATIONS MAP I-63. C. F. Miller.
Washington, U. S. Geological Survey, 1955. $0.50.

6972

PHOTOGEOLOGIC MAP OF THE BLUFF-1 QUADRANGLE,
SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC
INVESTIGATIONS MAP I-64. C. F. Miller. Washington,
U. S. Geological Survey, 1955. $0.50.

6973

PHOTOGEOLOGIC MAP OF THE CLAY HILLS-11 QUAD-
RANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS
GEOLOGIC INVESTIGATIONS MAP I-65. C. H. Marshall.
Washington, U. S. Geological Survey, 1955. $0.50.

6974

PHOTOGEOLOGIC MAP OF THE NAVAJO MOUNTAIN-2
QUADRANGLE, KANE AND SAN JUAN COUNTIES, UTAH.
MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-66.
H. S. Bennett. Washington, U. S. Geological Survey, 1955.
$0.50.

6975

PHOTOGEOLOGIC MAP OF THE CARLISLE-2 QUAD-
RANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS
GEOLOGIC INVESTIGATIONS MAP I-67. J. S. Detterman.
Washington, U. S. Geological Survey, 1955. $0.50.

6976

PHOTOGEOLOGIC MAP OF THE CARLISLE-3 QUAD-
RANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS
GEOLOGIC INVESTIGATIONS MAP I-68. C. E. Bates.
Washington, U. S. Geological Survey, 1955. $0.50.

6977

PHOTOGEOLOGIC MAP OF THE CARLISLE-4 QUAD-
RANGLE, WAYNE AND SAN JUAN COUNTIES, UTAH.
MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-69.
V. H. Sable. Washington, U. S. Geological Survey, 1955.
$0.50.

6978

PHOTOGEOLOGIC MAP OF THE CARLISLE-5 QUAD-
RANGLE, WAYNE AND SAN JUAN COUNTIES, UTAH.
MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-70.
V. H. Sable. Washington, U. S. Geological Survey, 1955.
$0.50.

6979

PHOTOGEOLOGIC MAP OF THE CARLISLE-6 QUAD-

RANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS
GEOLOGIC INVESTIGATIONS MAP I-71. C. E. Bates.
Washington, U. S. Geological Survey, 1955. $0.50.

6980

PHOTOGEOLOGIC MAP OF THE CARLISLE-7 QUAD-
RANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS
GEOLOGIC INVESTIGATIONS MAP I-72. V. H. Sable.
Washington, U. S. Geological Survey, 1955. $0.50.

6981

PHOTOGEOLOGIC MAP OF THE CARLISLE-10 QUAD-
RANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS
GEOLOGIC INVESTIGATIONS MAP I-73. J. S. Detterman.
Washington, U. S. Geological Survey, 1955. $0.50.

6982

PHOTOGEOLOGIC MAP OF THE CARLISLE-11 QUAD-
RANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS
GEOLOGIC INVESTIGATIONS MAP I-74. J. N. Platt.
Washington, U. S. Geological Survey, 1955. $0.50.

6983

PHOTOGEOLOGIC MAP OF THE CARLISLE-12 QUAD-
RANGLE, WAYNE, SAN JUAN, AND GARFIELD COUNTIES
UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-75. J. N. Platt. Washington, U. S. Geological
Survey, 1955. $0.50.

6984

PHOTOGRAPHIC MAP OF THE CARLISLE-15 QUAD-
RANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS
GEOLOGIC INVESTIGATIONS MAP I-76. R. J. Hackman.
Washington, U. S. Geological Survey, 1955. $0.50.

6985

PHOTOGEOLOGIC MAP OF THE NAVAJO MOUNTAIN-7
QUADRANGLE, KANE AND SAN JUAN COUNTIES, UTAH.
MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-77
H. S. Bennett. Washington, U. S. Geological Survey, 1955.
$0.50.

6986

PHOTOGEOLOGIC MAP OF THE CLAY HILLS-10 QUAD-
RANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS
GEOLOGIC INVESTIGATIONS MAP I-78. C. H. Marshall.
Washington, U. S. Geological Survey, 1955. $0.50.

6987

PHOTOGEOLOGIC MAP OF THE CLAY HILLS-9 QUAD-
RANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS
GEOLOGIC INVESTIGATIONS MAP I-79. P. P. Orkild.
Washington, U. S. Geological Survey, 1955. $0.50.

6988

PHOTOGEOLOGIC MAP OF THE BLUFF-12 QUADRANGLE
SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC
INVESTIGATIONS MAP I-80. P. P. Orkild. Washington,
U. S. Geological Survey, 1955. $0.50.

6989

PHOTOGEOLOGIC MAP OF THE STRAIGHT CLIFFS-8
QUADRANGLE, KANE COUNTY, UTAH. MISCELLANEOUS
GEOLOGIC INVESTIGATIONS MAP I-81. B. H. Kent.
Washington, U. S. Geological Survey, 1955. $0.50.

6990

PHOTOGEOLOGIC MAP OF THE ELK RIDGE-1 QUAD-
RANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS
GEOLOGIC INVESTIGATIONS MAP I-82. C. F. Miller.
Washington, U. S. Geological Survey, 1955. $0.50.

METALS AND METALLURGY

6991   ANL-5430
Argonne National Lab., Lemont, Ill.
CORROSION RESISTANT ALUMINUM ABOVE 200°C.
J. E. Draley and W. E. Ruther. July 15, 1955. 37p.
Contract W-31-109-Eng-38.

At elevated temperatures most aluminum alloys in water
suffer severe penetrating attack, resulting in relatively
rapid destruction of the material. This penetrating attack
is explained in terms of mechanical damage as a result of
diffusion of corrosion-product hydrogen into the metal. It
is prevented by adding to the water cations which are re-
duced on the aluminum to form deposits of low hydrogen
overvoltage metals. It is also prevented in untreated water
by using alloys of aluminum with the same metals. Alloy-
ing metals observed to be beneficial are nickel, copper,
cobalt, iron, platinum, with nickel probably the most
effective. There has been developed an alloy, containing
approximately 1% nickel in 2S aluminum, which appears to
be completely safe against the penetrating attack. It is
easy to make and is workable. It probably can be used,
from a corrosion-resistant point of view, wherever its
normal reaction rate with water or a solution is tolerable.
Penetration rates in static distilled water are approxi-
mately 1, 1.5, 3 and 9 mils per year at 250°, 290°, 315°,
and 350°C, respectively. They are higher where there is
significant flow velocity of water past metal. (auth)

6992   BRB-6
Bridgeport Brass Co., Conn.
DRAW BENCH LOAD CALIBRATION. M. T. McGowan,
H. S. Rubenstein, and R. M. Treco. Aug. 1, 1955. 15p.
Contract AT(30-1)-1405.

An accurate method has been devised to determine forces
involved in drawing operations on the Pilot Plant draw
bench, No. 2204. The draw bar load-strain curve developed
with data obtained from strain gage measurements accu-
rately indicates the force applied. This method is inde-
pendent of hydraulic turbulence or other extraneous effects.
The only remaining errors in draw load observations are
those due to the weight of the grip-jaw holder and errors
in observing dynamic strain values. Both of these can be
eliminated with proper recording equipment. (auth)

6993   CEA-352
France. Commissariat a l'Énergie Atomique, Paris.
CONSTRUCTION ET APPLICATION D'UN PORTE-
ÉCHANTILLON À DOUBLE BALLADAGE. [Construction
and Application of a Double Scanning Sample Holder].
J. Petit and G. Cabane. 1954. 15p.

Crystal growth often interferes in the analysis of
orientation textures of annealed sheets. In order to
achieve the hitting of a great number of grains by the x-
ray beam, the sample must be moved in its own plane, the
rolling direction remaining parallel to itself. For the
study of rolled uranium annealing, one linear scanning was
found insufficient. A double-scanning sample holder was
developed, allowing the survey of a surface up to 6 or 8
cm^2. Thus, for recrystallized samples with a grain
diameter up to 1 mm, continuous diffraction lines can be
obtained. The first diagrams confirm the dilatometric
results relating to the texture changes due to α annealing
hard-rolled sheets or to the $\alpha-\beta$ allotropic transforma-
tion. (auth)

6994   KAPL-1371
Knolls Atomic Power Lab., Schenectady, N. Y.
PREPARATION OF NUCLEAR POISON AND CONTROL
ALLOYS. STAINLESS STEEL BASE – BORON ALLOYS.
A. P. Beard, C. J. Beck, J. W. Harrison, and W. B. Clark.
June 17, 1955. 31p. Contract W-31-109-Eng-52.

Stainless steel base boron alloys with nominal composi-
tions of 18 wt.% boron were successfully cast into ingots by
vacuum induction melting. Alloy ingots containing up to
2.4 wt.% B were fabricated into 0.100-in. strip by forging
and rolling at 1140 to 1175°C. An ingot containing 3.2 wt.%
B could not be fabricated by the same procedure. Chemical
analyses on as-cast ingots and rolled strip indicated very
high B recovery and good homogeneity. Brinell hardness
numbers of the alloys were directly proportional, and
measured densities were inversely proportional to B con-
tent. (auth)

6995   NACA-TN-3293
National Bureau of Standards, Washington, D. C.
CUMULATIVE FATIGUE DAMAGE OF AXIALLY LOADED
ALCLAD 75S-T6 AND ALCLAD 24S-T3 ALUMINUM-
ALLOY SHEET. Ira Smith, Darnley M. Howard, and
Frank C. Smith. Sept. 1955. 49p.

Results are presented of cumulative-fatigue-damage
tests made on 607 specimens machined from alclad 75S-T6
aluminum-alloy sheet 0.064 in. thick and 198 specimens of
alclad 24S-T3 and alclad 75S-T6 aluminum-alloy sheet
0.032 in. thick. The tests of the 0.064-in.-thick specimens
consisted of 35 different loading conditions and the tests of
the 0.032 in. material consisted of 13 different loading con-
ditions. (NACA abst.)

6996   NACA-TN-3493
Brooklyn. Polytechnic Inst.
DEVELOPMENT OF EQUIPMENT AND OF EXPERI-
MENTAL TECHNIQUES FOR COLUMN CREEP TESTS.
Sharad A. Patel, Martin Bloom, Burton Erickson, Alexander
Chwick, and N. J. Hoff. Sept. 1955. 20p.

Equipment and procedures developed for testing alumi-
num-alloy columns subjected to constant loads at elevated
temperatures are described. Particular emphasis was put
on determination of the influence of initial deviations from
straightness on the critical time of the column, that is, the
time necessary for the column to buckle when subjected to
a constant load. Results are presented of tests on a number
of 2024-T4 aluminum-alloy columns having large slender-
ness ratios. (ASTIA abst.)

6997   NP-5736
Illinois Inst. of Tech., Chicago. Armour Research
   Foundation.
SOLID SOLUTION HARDENING OF ALPHA AND BETA
TITANIUM. Summary Report [for] August 19, 1953 to
August 19, 1954. J. J. Rausch and D. J. McPherson. 82p.
Project No. B-060. Contract DA-11-022-ORD-1439.

The separate effects of Al, Fe, V, Mo, Cr, Mn, Si, O,
N, and C as solid solutes in α-Ti, and of Cr, Fe, V, Mn,
and Mo as solid solutes in β-Ti were determined quantita-
tively. The effects of combinations of two and three of the
elements on alpha and beta solid solutions of Ti were also
studied. (auth)

6998   NP-5737
Case Inst. of Tech., Cleveland.
TOUGHENING HIGH STRENGTH STEEL BY WARM WORK-
ING. Technical Report No. 32 [on] THE EFFECTS OF

STRESS CONCENTRATION AND TRIAXIALITY ON THE
PLASTIC FLOW OF METALS. E. J. Ripling. Sept. 1955.
27p. Project NR-031-049. Contract N6-ONR-273/I.

The poor toughness associated with SAE 1340 steel at
high strength levels can be greatly improved (two to seven
fold) by warm working. This is accompanied by an ap-
preciable increase in yield strength, a slight increase in
tensile strength and ductility as well as by a mild loss in
hardness. A somewhat smaller toughness improvement
accompanied by a smaller hardness loss is found in warm-
worked SAE 4340 steel. (For preceding report see NP-
5514.) (auth)

6999   NP-5739
Mine Safety Appliances Co., Callery, Penna.
PROGRESS REPORT NO. 29 FOR JUNE AND JULY 1955.
J. W. Mausteller, ed. Aug. 19, 1955. 53p. Contract
NObs-65426.

Tests at cyclic conditions were initiated on the Mark B
3000-kw steam generator; the extent of NaK heat failures
and water carry-over in the boiler was determined. Studies
were continued on the natural circulation of liquid metal
system components around heated vertical cylinders and
about the heat transfer characteristics of liquid metals in
cross flow. Modifications and improvements were made on
the electromagnetic pumps, liquid level gages, and pressure
gages. The effect of pretreatment of the surfaces on the
wetting of surfaces with liquid Na was investigated. Testing
continued on the valve welds and the Mark A bellows. The
studies of radiation hazards arising from reactor cooling
system leaks and from chemical reactions between steam
and reactor molten metals were continued. The removal
of residual radioactive Na using sodium flushes was
shown to be dependent upon the degree of mixing of the
flush and residual sodium. (For preceding period see NP-
5690.) (C.W.H.)

7000   NP-5749
Illinois Inst. of Tech., Chicago. Armour Research Founda-
tion.
DEVELOPMENT OF TRANSFORMATION DATA FOR
SPECIAL TITANIUM ALLOYS. Interim Technical Report
No. 5 [for] December 1, 195[4]—April 30, 1955. A. W.
Goldenstein and W. Rostoker. May 6, 1955. 29p. Project
No. B-057. Contract DA-11-022-ORD-1292.

The isothermal transformation characteristics of a 6%
aluminum and 4% vanadium titanium alloy have been
studied. The investigation included the establishment of a
TTT chart, metallographic examination of transformed
structures and measurement of tensile and impact proper-
ties of transformed specimens. Some correlation between
the mechanical properties and structure was established.
Isothermal transformation heat treatments which produced
optimum tensile and impact properties, and those which
induced brittleness were recognized. (auth)

7001   NYO-7168
Franklin Inst. Labs. for Research and Development,
Philadelphia.
TECHNICAL PROGRESS REPORT. Section I. [PROGRESS
ON WORK]. Section II. DIFFUSION OF ZINC IN SINGLE
CRYSTALS OF SILVER. A. Sawatsky and F. E. Jaumot, Jr.
Sept. 1955. 15p. Contract AT(30-1)-1484.

The diffusion of Zn in Ag has been measured in the tem-
perature range from 640°C to 925°C, using high specific
activity Zn[65] as a tracer. The data indicate that the diffu-

sion coefficient is given to within two percent by the equa-
tion D = 0.54 exp (−41,700/RT) cm²/sec. (auth)

7002   TID-3039(Suppl.1)
Technical Information Service, AEC.
TITANIUM METALLURGY: A BIBLIOGRAPHY OF
UNCLASSIFIED REPORT LITERATURE. Hugh E. Voress,
comp. Feb. 1955. 62p.

This supplement contains 340 selected annotated ref-
erences to unclassified reports on titanium metallurgy
which were available for review at the Technical Informa-
tion Service from April 1953 to February 1955. Author,
subject, and report number indexes are included. (auth)

7003   TID-5131
[Metallurgy Development Advisory Committee, AEC].
REPORT OF THE AEC COOPERATIVE METALLO-
GRAPHIC GROUP ON ZIRCONIUM-BASE ALLOYS. R. M.
Treco, R. F. Dickerson, and H. P. Roth. Mar. 15, 1953.
Decl. Apr. 18, 1955. 61p. (DCF-1018)

This report is based upon the work of the Metallographic
Committee as presented at a meeting held under the
auspices of the Knolls Atomic Power Laboratory on June
13 and 14, 1951.

A series of dilute binary alloys of zirconium were
prepared and examined metallographically for second-
phase constituents. Detailed microstructures are presented
for various heat treatments of each alloy as well as in-
formation on preparation and examination of alloy samples.
(auth)

7004   WADC-TR-54-278(Pt.1)
Illinois Inst. of Tech., Chicago. Armour Research
Foundation.
TITANIUM ALLOYS FOR ELEVATED TEMPERATURE
APPLICATION. Covers Period of Work from June 1953
to May 1954. W. F. Carew, F. A. Crossley, and D. J.
McPherson. June 1955. 170p. Project title: METALLIC
MATERIALS. Task title: TITANIUM METAL AND
ALLOYS. Contract AF33(038)-22806.

Results on the following phases of the investigation are
presented: effect of carbon, nitrogen and oxygen on the
tensile, impact and creep-rupture properties of Ti−6% Al
alloy; tensile test evaluation of experimental alloys in-
cluding binary alloys of β stabilizing additions to titanium;
effect of vacuum annealing on tensile ductility of alloys
containing 8% or more of aluminum; creep-rupture evalu-
ation of alloys; creep evaluation of alloys; evaluation of
stability of room-temperature tensile properties upon ex-
posure to creep at elevated temperatures; and evaluation of
the rolling and welding characteristics of the alloys: 6%
Al−0.5% Si, 6% Al−4% V and 7% Al−3% Mo. The additions
carbon, nitrogen and oxygen were found to improve tensile
strength of the 6% Al alloy at temperatures to 550°C, the
highest test temperature. Additions of 0.3% nitrogen and
0.5% oxygen produce complete embrittlement at room tem-
perature. All impact values were low and it is believed that
this was due to hydrogen contamination. The additions im-
proved creep and rupture performace of the 6% Al alloy at
425°C, but at 550°C their contributions were less signifi-
cant. The tensile ductility of alloys containing 8% or more
aluminum was not improved by vacuum annealing to re-
move hydrogen. Of the alloys having better than 10%
tensile elongation as heat treated to a stable condition,
the 7% Al−3% Mo alloy showed the best creep and rupture
strength properties. Also, specimens of this alloy were

found to be ductile after exposure to elevated temperature creep conditions for 1000 hours. Specimens of the 6% Al—2% V and 4% V alloys were also ductile after exposure to creep conditions for 1000 hours. The 6% Al— 0.5% Si and 1% Si alloys were found to embrittle upon exposure to creep conditions. The three alloys 6% Al— 0.5% Si, 6% Al—4% V and 7% Al—3% Mo were readily rolled. Tensile and bend tests on weldments of these alloys were somewhat disappointing. The results indicated that further study of the factors influencing ductility in unwelded and welded sheet should prove fruitful. (auth)

7005   WAL-401/97-34
Battelle Memorial Inst., Columbus, Ohio.
THE EFFECTS OF INTERSTITIAL ELEMENTS ON WELDS IN ALPHA-BETA TITANIUM ALLOYS. Interim Technical Report. W. J. Lewis, M. L. Kohn, and G. E. Faulkner. Mar. 31, 1955. 38p. Contract DA-33-019-ORD-1524.

Eighty-one experimental alpha-beta titanium alloys were prepared and fabricated to plate with the objective of determining the effect of interstitial elements on the mechanical properties of welds in these alloys. The results of welding tests on 18 of these alloys showed that the differences in interstitial content between iodide- and sponge-base alloys had considerable effect on base-metal tensile strength (sponge-base alloys 15,000 to 18,000 psi higher tensile strength than iodide-base alloys), but generally had only a slight effect on weld-joint bend ductility and weld-metal notch toughness. The tests also showed that, in alloys with increasing amounts of substitutional elements, base-metal tensile strength increased and weld-joint bend ductility and weld-metal notch toughness decreased. (auth)

7006   AEC-tr-2217
ELECTRODE POTENTIALS OF METALS IN MOLTEN SALTS. THE UNIT SCALE OF ELECTRODE POTENTIALS. Iu. K. Delimarskii. Translated from Zhur. Fiz. Khim. 29, 28-38(1955). 24p.

Several electrode potentials of metals have been computed from decomposition potentials of molten electrolytes, taking the electrode potential of Na in its pure fused salt as zero. A unit scale of electrode potentials in molten salts was constructed from these data. The effects of temperature, chemical reaction between components, and anion character on the electrode potentials were discussed. (auth)

7007   AERE-Lib/Trans-467
THE INFLUENCE OF OXIDE FILMS ON THE MECHANICAL PROPERTIES OF CADMIUM MONOCRYSTALS. V. I. Likhtman and V. S. Ostrovskii. Translated by J. Makin from Doklady Akad. Nauk S.S.S.R. 93, 105-7(1953). 4p.

The oxide film on the monocrystals studied was created under a definite régime of oxidation. The samples were annealed in air at a temperature of 230° for 2 hr. With this oxidation régime the film of oxide formed had a thickness of about 900A. The thickness of the film was determined gravimetrically with an accuracy of weighing on the microbalance of 2×10^{-6}g, which amounted to about 5% of the weight increase to be measured. The density of CdO was taken from tables ($8.15g/cm^3$). The mechanical properties of Cd monocrystals were investigated under conditions of constant rate of extension, $\nu = 1.5\%$ min.$^{-1}$. Results indicate that the influence of oxide films on the mechanical properties of the metal single crystals is an effect of the mechanical properties of the oxide film. Their effect is shown not only in an increase of the yield point, but also in increasing the difficulty of further deformation of the single crystal in the main plastic range. (auth)

7008
DIFFUSION OF ZINC AND COPPER IN ALPHA AND BETA BRASSES. R. Resnick (Sylvania Electric Products Inc., Bayside, N. Y.) and R. W. Balluffi (Univ. of Illinois, Urbana). J. Metals 7, 1004-10(1955) Sept.

The results show that all of the phenomena presently associated with the Kirkendall effect in α brass accompany diffusion in β brass and that diffusion in this body-centered-cubic alloy is, therefore, at least outwardly, similar to diffusion in the face-centered-cubic structure. Diffusion is much more rapid, however, in the nonclose-packed body-centered-cubic phase, as seems to be the case in other systems where diffusion rates in face-centered-cubic and body-centered-cubic phases have been compared. (auth)

7009
LINEAGE STRUCTURE IN ALUMINUM SINGLE CRYSTALS. A. Kelly and C. T. Wei (Univ. of Illinois, Urbana). J. Metals 7, 1041-2(1955) Sept.

It was found possible, by x-ray method, to make a rapid survey of the perfection of a single crystal at a particular surface. The method has the advantage of allowing a large surface of a specimen to be examined by taking a single photograph and it compares well with other x-ray methods in regard to sensitivity of detection of small angle boundaries. During the course of a survey of the perfection of large crystals of Al, an examination was made of a number of single crystals produced from the melt using soft mold. (auth)

7010
RELATIONSHIP BETWEEN RECOVERY AND RECRYSTALLIZATION IN SUPERPURITY ALUMINUM. E. C. W. Perryman (Aluminium Laboratories Ltd., Kingston, Ont., Canada). J. Metals 7, 1053-64(1955) Sept.

The recovery and recrystallization characteristics of superpurity aluminum have been investigated using electrical resistivity, x-ray line breadth, and hardness measurements for the former and the micrographic method for the latter. The three different properties recover at different rates and have different activation energies. The recrystallization results agree well with Avrami's theory and furthermore indicate that the perfect subgrains formed during recovery are not the nuclei for recrystallization. (auth)

7011
PRINCIPLES APPLICABLE TO THE OXIDATION AND CORROSION OF METALS AND ALLOYS. W. W. Smeltzer (Aluminium Laboratories, Ltd., Kingston, Canada). Corrosion 11, 366t-74t(1955) Sept.

Phenomenological basis of kinetic laws governing oxidation is described to illustrate manner of growth and protective properties of oxide films on metals. Metals are separated into groups forming "metal-excess" and "metal-deficit" oxide films and emphasis is placed on role of lattice defects in governing diffusion of metal through film to react with environment. Effects of alloying elements on oxidation rates of metals are discussed in terms of formation of films consisting of heterogeneous mixtures and solid solutions of oxides and intramolecular oxides. Special reference is made to aluminum and its alloys for illustrative examples. (auth)

7012

THE POROSITY OF THE ALUMINUM SURFACE INVESTI-
GATED BY THE REPETITIVE OSCILLOGRAPHIC METHOD.
W. Machu, E. M. Khairy, and M. K. Hussein (Univ. of Cairo,
Egypt). Corrosion 11, 375t-8t(1955) Sept.

Experiments are reported using a repetitive oscillographic
method to investigate the anodic behavior of spectroscopi-
cally pure aluminum exposed to a variety of electrolytes in-
cluding buffer solutions of pH 6, 7 and 8, sulfuric acid and
sodium sulfate, nitric acid and sodium nitrate, hydrochloric
acid and sodium chloride, acetic acid, oxalic acid and disodium
hydrogen phosphate. The method permits determination of
the part of the surface area covered by the passivating layer
formed through anodic polarization. Results of tests in
various electrolytes are reported. Authors postulate the
repetitive oscillographic method in combination with the di-
rect polarization method provides a means of testing among
reactions occurring at a metal anode. (auth)

7013

THE SYSTEM URANIUM–TITANIUM. A. G. Knapton
(Associated Electrical Industries, Ltd., Aldermaston,
Berks, England). J. Inst. Metals 83, 497-504(1955) Aug.

The liquidus and solidus in the uranium–titanium system
show a smooth increase from the melting point of uranium
to that of titanium. A continuous series of solid solutions is
formed between the γ modification of uranium and the β
modification of titanium. The addition of titanium lowers the
β to γ transformation from 771°C in pure uranium to a eutec-
toid with the intermediate $\epsilon(U_2Ti)$ phase at 723°C, 4 at.%
titanium. Beta uranium dissolves about $1\frac{1}{2}$ at.% titanium at
the eutectoid temperature. An hexagonal phase, ϵ, having
the C32 structure, separates at 898°C from the γ solid solu-
tion. A eutectoid is formed between ϵ and α titanium at
655°C, 83 at.% titanium. The solubility of uranium in α
titanium at the eutectoid temperature is about 0.8 at.% and
the solubility of titanium in α uranium is < 1 at.%. (auth)

7014

THE CONSTITUTION OF URANIUM ALLOYS. [A JOINT
DISCUSSION BY SEVERAL AUTHORS, OF PAPERS PRE-
VIOUSLY PUBLISHED IN THIS JOURNAL]. J. Inst. Metals
83, 535-40(1955) Aug.

7015

TRACER DIFFUSION OF IRON IN STAINLESS STEEL.
V. Linnenbom, M. Tetenbaum, and C. Cheek (Naval Re-
search Lab., Washington, D. C.). J. Appl. Phys. 26, 932-6
(1955) Aug.

The tracer diffusion of iron in 18–8 stainless steel has
been measured over a wide temperature range by the surface
activity decrease method, using radioactive Fe^{55}. The
results show that the lattice diffusion coefficients can be
described by the equation $D = 0.58 \exp(-67\,100/RT)$
$cm^2\ sec^{-1}$. The effect of variations in grain size has been
determined, and it has been shown that when the grain size
is small, grain boundary diffusion contributes appreciably
to the over-all diffusion process, this effect decreasing with
increasing temperature. (auth)

7016

ANALYTICAL CHEMISTRY OF TITANIUM ALLOYS.
Maurice Codell, George Norwitz, and James J. Mikula
(Frankford Arsenal, Philadelphia). Anal. Chem. 27, 1379-
83(1955) Sept.

A general survey of the analytical chemistry of titanium
alloys is made, including methods of dissolving the sample,
complexation, separations, and application of instrumental

methods of analysis. A survey of the methods used for the
determination of many elements in titanium and titanium
alloys is included. Sampling procedures are discussed.
(auth)

7017

LOW NICKEL TYPE 329 OFFERS GOOD CORROSION
RESISTANCE. R. A. Lula, W. G. Renshaw, and J. B. Hill
(Allegheny Ludlum Steel Corp., Pittsburgh). Iron Age 176,
No. 10, 74-6(1955) Sept. 8.

Type 329 stainless steel containing 4% Ni offers corro-
sion resistance that is almost as good as type 316. Because
of its better-than-average properties, 329 alloy can be
substituted for more critical materials in some industrial
applications. It is a duplex structure alloy with a ferritic
matrix and small austenite pools. It closely approximates
the 400 series of stainless steels in structure and proper-
ties. The typical microstructure of type 329 consists of a
matrix of ferrite with small elongated stringers of austenite
and carbide. The amount of austenite varies from 20 to
40%. It is subject to both 885°F embrittlement and the
formation of sigma phase and can be welded but the welds
tend to be brittle. Annealing was found to improve its
properties. (J.E.D.)

7018

A THEORY OF FRACTURE AND FATIGUE. N. F. Mott
(Univ. of Bristol, England). J. Phys. Soc. Japan 10, 650-
6(1955) Aug.

The concept of a piled-up group of dislocations is dis-
cussed, and its relation to ductile fracture, to brittle
fracture and to fatigue. It is suggested that a large enough
stress induces fracture at a piled-up group, and a large
number of such small cracks can join together to produce
a ductile or fatigue fracture. (auth)

7019

THE INTERPRETATION OF ETCH PATTERNS ON
ALUMINIUM. A. J. Forty and F. C. Frank (Univ. of Bristol,
England). J. Phys. Soc. Japan 10, 656-63(1955) Aug.

An examination of etch patterns obtained with Lacombe's
etchant on polycrystals of "super-purity" Al suggests that
an etch pit is produced only where there is a precipitate of
impurity present in the surface, and that these are located
on dislocations which can therefore be regarded as an in-
direct cause of etching. It is tentatively estimated that, at
best, only about 60 to 70% of the dislocations in super purity
Al produce etch pits. (auth)

PHYSICS

7020   AERE-EL/M-90

Gt. Brit. Atomic Energy Research Establishment, Harwell,
  Berks, England.
CHEMICAL PLANT INSTRUMENTATION. A TECHNIQUE
FOR PRODUCTION OF THIN RUBBER HYDROCHLORIDE
FILMS. C. E. L. Gingell and H. Bisby. Apr. 25, 1955. 5p.

A technique for producing rubber hydrochloride films
mounted on 5 cms. diameter mica rings is described. The
method has been used for thicknesses down to 0.175×10^{-3}
inches, i.e. 0.5 milligrams/cm^2. (auth)

7021   CEA-360

France. Commissariat à l'Énergie Atomique, Paris.
UNITÉS DE MESURE DES GRANDEURS PHYSIQUES.

[Measurement Units of Physical Values]. P. Debraine. 1955. 150p.

An analysis is given of the various systems of units. Practical problems involving changes of units are discussed. (B.J.H.)

7022 COO-143

Wichita, Kan. Univ. Foundation for Industrial Research. THE PERMEABILITY METHOD OF DETERMINING SURFACE AREAS OF FINELY DIVIDED MATERIALS. May 12, 1955. 34p. Contract AT(11-1)-203.

Experiments were performed on a system in which an adsorbable gas flowed through a porous barrier in order to obtain data relating the amount of surface flow to the variables of the system. Results for the flow of CO_2 through a porous glass barrier do not show a dependency of the amount of surface flow on the concentration gradient in the adsorbed layer. Surface flow appears to depend directly on the total amount of gas adsorbed, at the average pressure of the measurement. (D.E.B.)

7023 NP-4859(Suppl.6)

Little (Arthur D.) Inc., Cambridge, Mass. LOW TEMPERATURE BIBLIOGRAPHY FOR THE FIELD OF CRYOGENICS. Supplement No. 6. June 1955. 8p.

7024 NP-5738

Massachusetts Inst. of Tech., Cambridge. Div. of Industrial Cooperation. CORRELATION OF MAXIMUM HEAT FLUX DATA FOR BOILING OF SATURATED LIQUIDS. Technical Report No. 6. Warren M. Rohsenow and Peter Griffith. Mar. 1, 1955. 8p. ONR Project No. NR-035-267. D.I.C. Project No. 6627. Contract N5ori-07827.

Data for the boiling of single component liquids show in the region of transition from nucleate boiling to vapor film boiling the existence of a maximum heat flux as the wall temperature is raised. An attempt is made to eliminate some and predict a quantitative effect for other of the variables which appear in a correlation by J. N. Addams. (D.E.B.)

7025 NP-5747

Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics. QUARTERLY PROGRESS REPORT [NO. 38 FOR THE PERIOD ENDING MAY 31, 1955]. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. July 15, 1955. 128p. DA Project 3-99-12-022. Contract DA-36-039-sc-42607.

A detailed investigation was made of cathode electron emission as a function of applied voltage. Additional information was obtained on the nonlinearity of ionization gages, and the results are graphed. A microwave determination was made of the probability of collision of slow electrons in neon. Results of observations on H^1, B^{11}, and F^{19} nuclear magnetic resonance in various binary mixtures of H_2, He, N_2, and BF_3 are tabulated. Equations are given for noise in electron beams. Work is reported on the theory of statistical communication and on the processing and transmission of information. Other topics discussed are speech analysis, various nonlinear circuits, and network synthesis. (B.J.H.)

7026 NP-5748

Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes. APPLICATION OF THE "DETONATION HEAD MODEL" TO THE MASS LOADING BY EXPLOSIVES. Technical Report No. XLVI. A. S. Filler and M. A. Cook. July 15,

1955. 24p. Project No. 357-239. Contract N7-onr-45107.

One of the important problems in explosives technology is the determination of the optimum inert solid explosives weight ratio in the design of devices wherein an explosive is used to hurl the solid (usually a metal). In connection with this problem consideration should also be given not only to the type of explosives but also to the charge configuration which will most efficiently utilize the pressure and energy generated by the explosive. The detonation head model is at present the only one which has been successful in attacking these and other vital practical problems related to end impulse phenomena. Since this model is based upon simple geometrical considerations, it may be readily applied to rather complicated charge configurations. This article was prepared to illustrate application of the calculations of optimum loading of solids by explosives as well as the relative efficiency of utilization of the explosive in each case. Examples as well as a brief description of the model are presented to provide sufficient information and background to permit one to make similar calculations on the basis of this model for any charge configuration desired. (auth)

7027 NRL-4575

Naval Research Lab., Washington, D. C. THE NEUTRON CONVERTOR: THERMAL NEUTRON FLUX CALIBRATION. H. M. Childers, J. D. Graves, and A. E. Nash. June 13, 1955. 13p. Projects NE 101-505-3 and NR 662-100.

A device for the production of fast and thermal neutron fields has been constructed and the thermal neutron fields calibrated. Using a one-half gram radium-beryllium source, thermal neutron fluxes, nv, of approximately 7000 per cm^2 per sec are obtained in the exposure position. The reproducibility was found to be 1.2% with an average deviation of 0.76%. The over-all estimated accuracy of calibration based on the National Bureau of Standards thermal neutron standard flux is about 4%. (auth)

7028 TID-3046(Suppl.1)

Technical Information Service, AEC. UTILIZATION OF FISSION PRODUCTS. A BIBLIOGRAPHY OF SELECTED UNCLASSIFIED LITERATURE. Gifford A. Young and Robert E. Allen, comps. June 1955. 55p.

A total of 249 unclassified reports and published articles of interest to the fission product utilization program and available as of May 1, 1955, have been annotated in this supplement. The annotations include information originating within the AEC and elsewhere on radiosterilization, radiation-induced initiation of chemical reactions, preparation and use of gamma sources, and nuclear batteries. Access to intense radiation sources for research is discussed in an introduction. (auth)

7029 AEC-tr-2221

PREPARATION OF SILVER CHLORIDE SPECIMENS FOR DEFORMATION STUDIES BY OPTICAL METHODS. S. O. Tsobkallo. Translated from Zavodskaya Lab. 15, 338-45(1949). 8p. Available from Associated Technical Services (Trans. 99G6R), East Orange, N. J.

Methods for the preparation of one-grain-thickness polycrystalline pieces, transparent ingots, ribbons, and one-grain-thickness slabs of silver chloride for optical studies are described. (D.E.B.)

7030 AEC-tr-2222

ACCELERATION OF CHARGED PARTICLES BY A MOVING MAGNETIZED MEDIUM. A. A. Logunov and Ya.

P. Terletskii. Translated from Zhur. Eksptl'. i Teoret. Fiz. 26, 129-38(1954). 10p. Available from Columbia Technical Translations, White Plains, N. Y.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-455.

7031

RADIOCARBON CONCENTRATION IN MODERN WOOD. Hans E. Suess (U. S. Geological Survey, Washington, D. C.). Science 122, 415-17(1955) Sept. 2.

Determination of C^{13} and C^{14} in wood samples reveal a decrease in the percent composition of these carbons in the past 50 years. A decrease of 3.4% over the past 50 years is determined and attributed to the presence of C^{14}-free CO_2 from coal and oil fuels. (D.E.B.)

7032

METHOD OF EXTRAPOLATING EQUATION-OF-STATE DATA TO HIGHER TEMPERATURES. Roger A. Strehlow (Ballistic Research Labs., Aberdeen Proving Ground, Md.). J. Chem. Phys. 23, 1562(1955) Aug.

Equation-of-state data have been extrapolated to pressures of 2500 atm and temperatures of 2000°K by the following procedure: the values of $Z = PV/RT$ were calculated and plotted against $1/T°K$ at constant pressure. These curves were then extrapolated to infinite temperature where Z is equal to one. The slope of the line in the region of infinite temperature was determined by calculating the value of Z using the virial equation of state $PV/RT = 1 + B/V + C/V^2 = Z$. The values of the virial coefficients were determined from the Lennard-Jones 6-12 potential model and the appropriate molecular constants. This extrapolation procedure assumes that there is no dissociation or ionization at any temperature. (C.W.H.)

7033

REACTION AT HIGH TEMPERATURES BETWEEN AIR AND LIQUID METAL SOLUTIONS CONTAINING SODIUM. EFFECT OF SOLUTION COMPOSITION. G. Pedro Smith, Mark E. Steidlitz, and Lloyd L. Hall (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 77, 4533-4(1955) Sept. 5.

Reaction between air at room temperature and jets of liquid metal solutions containing Na at temperatures of 600 to 800° was studied. The reactivity of the solutions showed a marked dependence on solution composition. The binary solution systems studied were: Na−Bi, Na−Cd, Na−In, Na−Pb, Na−Hg, Na−Ag, and Na−Sn. (auth)

7034

PLASMA OSCILLATIONS IN ELECTRON BEAMS. K. G. Hernqvist (RCA Labs., Princeton, N. J.). J. Appl. Phys. 26, 1029-30(1955) Aug.

Self-sustained ion and electron plasma oscillations have been observed simultaneously in an ion neutralized electron beam traveling in a transverse magnetic field. The observed frequencies of oscillation agree with the Langmuir-Tonks theory for plasma oscillations. Electron plasma oscillations occur when the electron plasma frequency equals the gyro frequency of a circular orbit in the magnetic field. (auth)

7035

POWER FLOW IN ELECTRON BEAMS. L. R. Walker (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 26, 1031-3(1955) Aug.

The a-c power flow in an electron beam moving in weak electric fields is given a precise definition. Since it is a quantity quadratic in the applied field strength its evaluation

requires the quadratic perturbation theory of the beam to b worked out. Quadratic expressions in the first-order variables of the beam and circuit may also be written down which have the dimensions of power and are shown to satisf a conservation theorem. The relations between the exact quantities of the nonlinear theory and the constructs from linear theory are discussed. (auth)

AEROSOLS

7036   CEA-335

France. Commissariat à l'Énergie Atomique, Paris. MESURE DE LA CONCENTRATION DES AEROSOLS RADIOACTIFS EMETTEURS α. [Determination of the Concentration of α Emitting Radioative Aerosols]. Jacque Labeyrie. June 15, 1953. 120p.

Thesis submitted to the Univ. of Paris.

Techniques used for the quantitative measurement of the concentrations of aerosols carrying short lived (radon or thoron daughters) or long-lived (uranium) α radioactive emitters are described. The problem of the determination of radon concentration in air by means of activity determinations on airborne dusts was investigated. Special reference is made to the measurement of the radon active deposit on two types of dusts (iron oxide (yellow) and uranium oxide) in small chambers (6 liters). Data resulting from determinations of radon and thoron concentrations in atmospheric air in the south Paris area using this method are given. (auth)

7037

SAMPLING FOR AIRBORNE RADIOACTIVITY. J. M. Heslep and A. W. Bellamy (Office of Civil Defense, Sacramento, Calif.). Air Repair 5, No. 1, 1-4(1955) May.

A general discussion is given of the nature and biological effectiveness of nuclear radiation, with special emphasis o the subjects of airborne radioactive materials and the methods of sampling and measuring such radioactivity. (B.J.H.)

COSMIC RADIATION

7038

SPATIAL DISTRIBUTION OF CHARGED PARTICLES AT SHORT DISTANCES FROM AXES OF EXTENSIVE ATMOS-PHERIC SHOWERS. O. I. Dovzhenko and S. I. Nikol'skii (Lebedev Physics Inst.). Doklady Akad. Nauk S.S.S.R. 102, 241-4(1955) May 11. (In Russian)

7039

MULTIPLE MESON PRODUCTION THEORIES APPLIED TO COSMIC-RAY SHOWERS. Osman El-Mofty and Mohamed El-Nadi (Univ. of Cairo, Giza, Egypt). Phys. Rev. 99, 921-5(1955) Aug. 1.

The multiple production theories are discussed from the point of view of multiplicity of produced mesons, and of the angular and radial distributions. Assuming that each π^0 meson produces a shower core, these theories are applied to the analysis of previous experiments on the structure of cosmic-ray showers. The analysis favors Fermi's theory with high anisotropy of angular distribution and it was found necessary to assume that only a small fraction of the energy in the original collision goes into the meson production. (auth)

7040

THE ENERGY BALANCE OF COSMIC RAYS. Hiroo Komor

(Nagoya Univ., Japan). Progr. Theoret. Phys. (Japan) 13, 205-16(1955) Feb.

The energy dissipated by the vertical flux of cosmic rays at three geomagnetic latitudes (λ = 56°, 28° and 3°) are studied. Comparing this result with the incident energy obtained from the intensity measurements at the free atmosphere, we find a difference of about thirty % which is nearly independent of the latitude. It is shown that this difference may be attributed to the low energy particles which cause the albedo effect near the top of the atmosphere. On the other hand, an alternative interpretation that the difference could be imputed to heavy unstable particles, especially K particles, may arise. We also examine this possibility and find out that all of the difference can not be ascribed to K particles. Taking account of the low energy particles, we can conclude that the energy balance is consistent with our present knowledge. Moreover we find the energy balance is consistent with out present knowledge. Moreover we find the energy ratios of neutral-to-charged π mesons to be 0.57 ± 0.07, 0.44 ± 0.07 and 0.36 ± 0.08 at λ = 56°, 28° and 3° respectively. (auth)

7041

ON THE EXTENSIVE AIR SHOWERS PENETRATING 10 cm OF LEAD OBSERVED AT 2,760 METERS ABOVE SEA LEVEL. Isao Miura, Tsuneo Matano, Yoshio Toyoda, and Takashi Murayama (Nagoya Univ., Japan). J. Phys. Soc. Japan 10, 595-9(1955) Aug.

The density distribution and the zenith angle distribution of extensive air showers were measured at 2,760 meters elevation, geomagnetic latitude 25°N, by a cloud chamber in connection with a hodoscope consisting of Geiger counter trays shielded by lead absorbers. The integral density spectrum of the extensive air showers followed the power law distribution and its exponent was 1.70 ± 0.13. The projected angle distribution of the extensive air showers followed the empirical law of $\cos^n \theta$, where n = 6.9 ± 1.3. (auth)

7042

OBSERVATIONS OF SLOW PARTICLES AND STARS IN NUCLEAR EMULSIONS EXPOSED AT 17 m.w.e. UNDERGROUND. Shin-ichi Kaneko, Tadayoshi Kubozoe, Moroe Okazaki, and Masaomi Takahata (Osaka City Univ., Japan). J. Phys. Soc. Japan 10, 600-9(1955) Aug.

Observations were carried out at a depth of 17 m.w.e. underground by nuclear plates made from Ilford G5 emulsions in gel form. The frequencies of μ mesons and protons coming to rest in the emulsions were found to be 0.262 ± 0.008 cm^{-3}day^{-1} and 0.049 ± 0.004 cm^{-3}day^{-1}, respectively. The angular distribution of these slow protons was found to be isotropic and so they are regarded as being of secondary origin from fast μ-mesons underground. In addition to the stars of the types of $N_h + 1_p$ with $N_h > 3$, several stars of the types of $1 + 1_p$ and $2 + 1_p$ were found with a cross section for production of a few times 10^{-30} cm^2 per nucleon. Some of the stars of the type of $1 + 1_p$ may possibly be explained by photoproton production through the giant resonance absorption by emulsion nuclei of virtual photons associated with high-energy μ mesons. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

7043   AERE-Lib/Trans-519
ON THE CRYSTAL STRUCTURE OF CARBON. Ulrich

Hofmann and Diederich Wilm. Translated by F. Hudswell from Z. Elektrochem. 42, 504-22(1936). 37p.

The characteristics of finely crystalline carbon, graphite, and activated carbon are investigated. Differences in lattice interferences in finely crystalline activated carbon and graphite, evaluation of the widening of interferences in crystal size determination, the formation of hexagonal planes in carbon from organic matter, formation temperatures of retort graphite, changes in crystals during burning, and lattice constants for Ceylon graphite, Acheson graphite, and single crystals of graphite are determined. (D.E.B.)

ELECTRICAL DISCHARGE

7044   CEA-368
France. Commissariat à l'Énergie Atomique, Paris. EXCHANGE DE CHARGES ENTRE IONS RAPIDES ET ATOMES NEUTRES. [Exchange of Charges Between Fast Ions and Neutral Atoms]. R. Geller. 1955. 28p.

Significant theoretical and experimental results obtained to date on the exchange of charges between fast ions and neutron atoms are summarized. (auth)

7045   AEC-tr-2219
THE STRIKING OF ELECTRICAL DISCHARGES IN GASES ON ALTERNATING CURRENT AT AUDIO FREQUENCIES IN TUBES WITH EXTERNAL AND INTERNAL ELEC-TRODES. N. A. Kaptsov and N. A. Popov. Translated from Zhur. Eksptl'. i Teoret. Fiz. 27, 97-102(1954). 6p. Available from Associated Technical Services (Trans. RJ-237), East Orange, N. J.

The conditions for the striking and maintaining of a discharge in tubes with external and internal electrodes are compared in relation to the frequency of the applied voltage. In the case of external electrodes the presence of two types of discharge is established: the unstable discharge at low voltages, and the stable discharge at higher voltages, and corresponding to these there there are two values for the striking voltage of the discharge. At frequencies of the order of 10 kc/sec the curves showing the relationship between striking voltage and frequency for both types of discharge approach each other. (auth)

7046   AERE-Lib/Trans-461
THE THEORY OF PROBES IN ELECTRONEGATIVE GASES. Johannes Wilhelm. Translated by R. J. Richardson from Ann. Physik 12, 401-9(1953). 8p.

An extended space-charge formula is given for measurements with plane probes in electronegative gases. The applicability and range of validity is discussed. (auth)

7047   AERE-Lib/Trans-514
ON AN INCANDESCENT-CATHODE VACUUM DISCHARGE IN GASES AND METALLIC VAPOURS, PARTICULARLY IRON VAPOUR, AND ITS APPLICABILITY IN SPECTROS-COPY. K. L. Wolf. Translated by J. B. Sykes from Z. Physik 44, 170-89(1927). 12p.

An electric discharge is proposed for gases and the vapors of metals that are not easily fusible, which is free from the defects attached to any arc discharge. Owing to the extreme constancy of all the conditions, the purity of the spectra, and the sharpness of the lines, this discharge appears suitable for a more exact determination of secondary wavelength standards. Further application, besides pressure broadening and pressure displacement of spectral lines, is the particular behavior of individual groups of

lines compared with the arc, illustrated by means of the Fe spectrum; this behavior might be of use for the arrangement of lines into multiplets and series. (auth)

ELECTRONS

7048　　AEC-tr-2218
INVESTIGATION OF THE ENERGY SPECTRUM OF AN ELECTRON IN AN IONIC SEMICONDUCTOR IN THE PRESENCE OF ELECTRIC AND MAGNETIC FIELDS. M. I. Klinger. Translated from Zhur. Eksptl'. i Teoret. Fiz. 26, 159-67(1954). 10p. Available from Columbia Technical Translations, White Plains, N. Y.

The energy spectrum of an electron interacting with optical oscillations of an ionic semiconductor, in applied mutually perpendicular electric and magnetic fields is investigated. It has been found that the effective mass of the current carrier depends on the electric and magnetic fields and also on the temperature. The momentum distribution of phonons is investigated. (auth)

7049　　AEC-tr-2220
ON THE THEORY OF A PROBE IN THE PLASMA. PART I. Yu. M. Kagan and V. I. Perel. Translated from Zhur. Tekh. Fiz. 24, 889-94(1954). 7p. Available from Associated Technical Services (Trans. 95G6R), East Orange, N. J.

In this article an expression is derived for the electron current to a spherical probe at the potential of the surrounding space in terms of the electron density in the unperturbed plasma. The formulae obtained show the explicit dependence on the pressure and on the probe dimensions. (auth)

7050　　UCRL-Trans-237(L)
MULTIPHOTON ANNIHILATION OF LARGE ENERGY POSITRONS WITH ELECTRONS. A. A. Abrikosov. Translated by S. Shewchuck from Doklady Akad. Nauk S.S.S.R. 102, 915-17(1955). 5p.

Equations are given for the determination of the energy spectrum and angular distribution of the resultant quanta in positron annihilation. (D.E.B.)

7051
ENERGY OF ELECTRONS OR PHOTONS FROM THEIR CASCADE SHOWERS IN COPPER. W. E. Hazen (Ecolè Polytechnique, Paris). Phys. Rev. 99, 911-14(1955) Aug. 1.

The photographs obtained by the Ecole Polytechnique cloud-chamber group have been used for the study of cascade showers in copper plates produced by electrons of known momentum. The best constant for obtaining primary energy from the total number of track segments if given. The uncertainty in primary energy as determined by this method is found from the experimentally observed distributions. The results are applied to the interpretation of the heavy S-particle observed at the Massachusetts Institute of Technology. (auth)

GASES

7052　　NBS-3991
National Bureau of Standards, Washington, D. C.
THERMODYNAMIC PROPERTIES OF ARGON-FREE AIR $(0.78847N_2, 0.21153O_2)$ to 15,000°K. Joseph Hilsenrath and Charles W. Beckett. July 7, 1955. 22p. NBS Project 0302-10-2699.

Sponsored by New York Operations Office, AEC.

The thermodynamic properties $(Z = PV/RT, E^*/RT,$ and $S^*/R)$ are given for equilibrium mixtures of dissociated and ionized molecules and atoms of the elements nitrogen and oxygen having the low temperature composition of .78847 N_2 and .21153 O_2. The tabulated properties of this mixture (a close approximation to the properties of air) are given at 1000° intervals from 2000° to 15,000°K for 26 densities — at uniformly spaced intervals of log ρ/ρ_0 — between 10 and 10^{-4} times the normal density. The tables include the equilibria between the species O_2, O_2^+, N_2, N_2^+, NO_2, N_2O, NO, NO^+, O^-, O, O^+, O^{++}, N, N^+, N^{++} and electrons. The method of calculation permits a simple correction for the effect of argon and CO_2 which will be made at a later stage. The calculations are based on 9.758 ev as the dissociation energy of nitrogen. (auth)

7053
RAPID GAS ANALYZER USING IONIZATION BY ALPHA PARTICLES. Paul F. Deisler, Jr., Keith W. McHenry, Jr., and Richard H. Wilhelm (Princeton Univ., N. J.). Anal. Chem. 27, 1366-74(1955) Sept.

A method and apparatus are presented for analysis of a flowing or quiescent gaseous mixture, by means of ionization of the mixture using α particles from polonium in an aged radium D source. By utilizing a proper combination of applied voltage and electrode spacing in the ionized mixture ionization currents of the order of 10^{-8} amp are obtained. The current depends in its precise value on the composition of the gas (binary, ternary, and possibly more components) at constant temperature and pressure. Primary calibration is necessary with recalibration or compensation at intervals. Electrical output may be recorded by a variety of devices or used in control systems. Theoretical time of response is of the order of 10^{-3} second; precision of analysis in the prototype apparatus was about 0.2 to 0.3 mole % for binary mixtures. (auth)

INSTRUMENTS

7054　　AERE-GP/M-175
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
POWER FLOW MONITORS FOR COAXIAL LINES. K. Dolder. Mar. 1955. 10p.

Two power monitors suitable for insertion into coaxial lines are described in detail. The first indicates either the forward or the reflected power flow irrespective of any mismatch on the line. The second records the difference between forward and reflected power flow. Both instruments are designed to operate at a frequency of 200 Mc and are suitable for a wide range of power levels. Power flow is indicated by a single meter reading in both cases. (auth)

7055　　CEA-325
France. Commissariat à l'Énergie Atomique, Paris.
LE PROBLÈME DES FUITES EN TECHNIQUE DU VIDE. RÉALISATION D'UN SPECTROMÈTRE DE MASSE DÉTECTEUR DE FUITES. [The Leak Problem in Vacuum Systems. Experimental Set-Up of a Mass-Spectrometer Detecting Leaks]. Richard Geller. Nov. 19, 1954. 104p.

Thesis submitted to the Univ. of Paris.

The first part of this paper is given to the consideration of leaks in vacuum systems and their detection. Special

attention is given to detection by a He spectrometer. The second part gives a detailed study of the analyzer and ion source in the experimental set-up. The technological and mechanical aspects of the apparatus and its performance are discussed. (auth)

7056   MLM-1045

Mound Lab., Miamisburg, Ohio.
A STABLE SHORT-RESOLVING-TIME PULSE DIS-CRIMINATOR.   J. W. Heyd and T. L. Zinn. Sept. 7, 1955. 10p. Contract [AT-33-1-GEN-53].

An electronic circuit is described wherein both positive and negative voltage pulses, having constant amplitude and width are produced. A type 6BN6 gated-beam tube is used in this equipment to provide pulse-shaping. The rectangular voltage pulses developed are one having a positive amplitude of 25 volts and one having a negative amplitude of 45 volts: both pulses have less than 0.5 microsecond duration. Input signals to this circuit are taken from a conventional radiation detector and consecutive input signals may have large variations in amplitude and width, however, all input signals greater than 0.25 volt magnitude and 0.25 microsecond duration will generate an output pulse. (auth)

7057   NBS-4257

National Bureau of Standards, Washington, D. C.
A RECORDING MICROWAVE HYGROMETER. Jack Sargent. June 1955. 58p. Sponsored by ONR; OSR; and AEC under Contracts NAonr-21-48 and CS-640-55-9.

A description is given of a microwave refractometer designed to measure and record the water-vapor pressure in air particularly at very low vapor pressures. At low water-vapor pressures the instrument has a sensitivity of 0.005 mb, with a four decade range extending to 95 mb. By means of microwave techniques the difference in refractive index between dry and humid air is determined and then converted to vapor pressure by an empirical formula. The instrument can be readily calibrated by the use of pure gases whose dielectric constants are precisely known. Because of the automatic null-balancing technique used, the calibration has exceptional stability. Test results involving the measurement of known vapor pressures in the ranges of 0 to 0.2 mb and 0 to 20 mb are described. Possible applications of this instrument for the measurement of refractive index variation, and its use for quality control, are briefly discussed. (auth)

7058   ORNL-1939

Oak Ridge National Lab., Tenn.
HERMETICALLY SEALED HIGH-TEMPERATURE PRESSURE TRANSMITTER AND HERMETICALLY SEALED HIGH-TEMPERATURE LIQUID-LEVEL PROBE. M. T. Morgan. Sept. 15, 1955. 14p. Contract W-7405-eng-26.

A hermetically sealed null-type pressure transmitter has been developed and tested for use at temperatures up to 1600°F. Continuous control and recording is possible by the use of an electrical control panel. The transmitter is accurate to ±0.1 psi operating at pressures up to 50 psi. Process fluid volume in the measuring chamber is less than 2 cc. A hermetically sealed liquid-level probe has been designed using two thermocouples opposed in a series circuit as the sensing element. The probe was tested at an operating temperature of 1350°F and was found to have a response time of less than two seconds. (auth)

7059   OSR-TR-55-17

Cornell Univ., Ithaca, N. Y.
ION SOURCE AND ANALYZER STUDIES. Technical Report No. 2 [on] THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE ATOMIC PHENOMENA OCCURRING ON AND NEAR THE SURFACES OF SOLIDS. R. C. Bradley. June 1, 1955. 25p. Project No. R-355-30-4. Contract AF18(600)-674.

A study of the operational characteristics of various types of ion sources and ion analyzers has been made for the purpose of investigating the kinds of atoms present on the surfaces of solids. The ion sources considered here were modifications of those initially due to Nier, Heil, and Finklestein. In the range of operating gas pressures considered ($10^{-4} - 10^{-5}$ mm of Hg) the Heil and Finklestein sources had the highest efficiencies in terms of the number of ions collected per emitted electron, but not as much higher as was expected from reports in the literature, being only of the order of a factor of 5. The low magnetic fields here may explain the difference. The methods of ion analysis considered were the Bennett r-f mass spectrometer and the appearance potential selector. These two were then compared to the conventional spectrometer. Of particular interest here were the relative intensities possible from the various methods. These typically are in the approximate ratio of $1:100:10000$ for the conventional spectrometer, the r-f spectrometer, and the appearance potential selector respectively. (auth)

ISOTOPES

7060   BNL-341

Brookhaven National Lab., Upton, N. Y.
PREPARATION OF FUSED CLAY RADIATION SOURCES. I. YTTRIUM MACROSPHERES. William S. Ginell and Robert Doering. June 1955. 6p.

A procedure is described for the fabrication of radiation sources by the incorporation of radioactive isotopes into fused montmorillonite spheres. Specific activities (~0.33 mc/mg) have been obtained using Y^{90}. (C.W.H.)

7061

FORMATION AND PROPERTIES OF NEUTRON-DEFICIENT ISOTOPES OF RHODIUM AND PALLADIUM. A. H. W. Atan, Jr. and T. De Vries-Hamerling. Physica 21, 597-8(1955) July. (In English)

The formation and properties of neutron-deficient isotopes of Rh and Pd are reported. Ru^{97} was isolated from Rh^{97} decay and found to have a 2.8-d half life and a 0.220-Mev γ emission. Pd^{98} with a 9-m half life from the decay of 17-m Rh^{98} is indicated. A half life of 24 m for the Pd^{99} mother of the 4.5 h Rd^{99} is determined. (D.E.B.)

7062

ISOTOPES: AN EIGHT-YEAR SUMMARY OF DISTRIBUTION AND UTILIZATION WITH BIBLIOGRAPHY. U. S. Atomic Energy Commission. Washington, U. S. Government Printing Office, March 1955. 357p. $2.00 (Paper cover)

ISOTOPE SEPARATION

7063   UCRL-3065

California, Univ., Berkeley. Radiation Lab.
THE PRODUCTION AND ISOLATION OF ASTATINE-211

FOR BIOLOGICAL STUDIES. Marshall W. Parrott,
Warren M. Garrison, Patricia W. Durbin, Muriel
Johnston, Harry S. Powell, and Joseph G. Hamilton.
July 1955. 8p. Contract W-7405-eng-48.

A method is described in detail for the routine prepara-
tion of mc amounts of At^{211} in a form suitable for animal
injection. (auth)

MASS SPECTROGRAPHY

7064

INFLUENCE OF SPACE CHARGE ON THE POTENTIAL
DISTRIBUTION IN MASS SPECTROMETER ION SOURCES.
W. M. Brubaker (Consolidated Engineering Corp., Pasadena,
Calif.). J. Appl. Phys. 26, 1007-12(1955) Aug.

The role of space charge as a factor influencing the
potentials and potential gradients in a mass spectrometer
ion source of the electron bombardment type is calculated.
Planar equipotential surfaces are assumed, and the analysis
then becomes that of a plane parallel positive ion diode. The
"cathode" of the ion diode may be either emission-limited
or space-charged-limited. The analysis considers the
charge of the electrons in the ionizing sheet and the charge
of the positive ions in the diode. At a critical gas pressure,
the influences of the positive and negative charges on the
potential of the ionizing region are equal and opposite for
small ionizing current. This concept leads to a pressure
normalization in terms of the critical pressure. For a
given source geometry and electron bombarding energy, one
can construct universal curves which give the potentials and
the potential gradients as a function of the normalized gas
pressure and the ratio of the ionizing electron current
density to the repeller voltage. Experimental data are in
agreement with the predictions of the theory. (auth)

MATHEMATICS

7065   DP-124

Du Pont de Nemours (E. I.) and Co. Savannah River
    Lab., Augusta, Ga.
IBM 650 SUB-ROUTINES. I. CIRCULAR AND HYPER-
BOLIC FUNCTIONS; REGULAR BESSEL FUNCTIONS.
W. V. Baxter. July 1955. 15p. Contract AT(07-2)-1.

In reactor computations employing the IBM 650, it is
desirable to have a sub-routine which will develop solutions
to the diffusion equation $\nabla^2\phi + B^2\phi = 0$ in various geom-
etries. In slab geometry, the solution to the equation is
expressed in terms of circular and hyperbolic functions.
In cylindrical geometry, the solution involves Bessel
functions. The sub-routine for Bessel functions described
in this report obtains only the regular functions, $J_n(x)$ and
$I_n(x)$. The irregular Bessel functions $Y_n(x)$ and $K_n(x)$ are
obtained by another sub-routine that will be published
later. The sub-routine described in this report computes
the functions sin x, cos x, sinh x, cosh x, $J_n(x)$, and $I_n(x)$
by series, using a variable number (N) of terms U_i, such
that the last term U_N becomes $< 10^{-8}$. A fixed decimal
argument is used to provide both fixed and floating decimal
answers. The programs occupy a block of 150 storages.
Most of the programs are coded for minimum access time.
The limitations on the values of the arguments of the
functions are listed. Two sets of coding are given: the
first is a series listing for key-punching; the second is a
detailed analysis for the individual functions. (auth)

7066   MonP-366

Clinton Labs., Oak Ridge, Tenn.
THE RESONANCE ESCAPE PROBABILITY FOR CON-
TINUOUS ABSORPTION. M. E. Rose. Aug. 25, 1947.
Decl. Oct. 29, 1953. 16p. Contract W-35-058-eng-71.

The problem of resonance escape probability in an
infinite homogeneous moderator is treated. Established
expressions for resonance escape probability in the case
of small absorption are presented and deviations from this
case listed. A solution to the problem employing the method
of the exponential kernel through the substitution of an
approximate kernel for the exact kernel is advanced.
(D.E.B.)

MEASURING INSTRUMENTS AND TECHNIQUES

7067   AERE-GP/R-1695

Gt. Brit. Atomic Energy Research Establishment, Harwell,
    Berks, England.
A MEASUREMENT OF SCHWARZCHILD'S CONSTANT.
A. H. Turnbull. June 14, 1955. 4p.

The report describes a simple method of measuring
Schwarzchild's constant for a photographic emulsion. (auth)

7068   BNL-358

Brookhaven National Lab., Upton, N. Y.
A HIGH PRESSURE PROPORTIONAL COUNTER FOR
FAST NEUTRON SPECTROSCOPY. S. D. Bloom, E. Reilly,
and B. J. Toppel. June 1955. 14p.

A high-pressure proportional counter has been built for
use as a fast neutron spectrometer. The sensitive cylindri-
cal volume defined by field tubes is 10-cm in diameter by
14-cm long. The counter is normally operated at voltages
of 6000 to 8000 v with pressures of from 6 to 10 atm.
Fillings of A, He, and Kr have been successfully used. The
use of a graphite liner on the cathode improves the resolu-
tion by a factor of three and eliminates the need for counter
degassing. The $He^3(n,p)T$ reaction using thermal neutrons
yields a resolution of 4.5%. The counter has been used to
study the $A^{36}(n,a)S^{33}$ reaction and to detect He^3 in normal
tank He. (auth)

7069   CERN-BS-22

European Organization for Nuclear Research, Geneva.
ELECTRON BACKGROUND IN IMPORTED G5 EMULSIONS.
V. D. Hopper and Jean E. Laby. Aug. 30, 1955. 8p.

Possible causes for the variations in the electron
background of four batches of Ilford G5 nuclear emulsions
are investigated. (D.E.B.)

7070   NP-5750

Massachusetts Inst. of Tech., Cambridge. Servo-
    mechanisms Lab.
ELECTRONIC NUCLEAR INSTRUMENTATION GROUP
ANNUAL PROGRESS REPORT FOR THE PERIOD MARCH
1, 1954 TO MARCH 1, 1955. Dept. of Electrical Engineer-
ing. T. S. Gray and A. B. Van Rennes. Mar. 1, 1955.
58p. D. I. C. Project No. 6986. ONR Project NR-025-164.
Contract N5ori-07876.

Progress is reported on the development of a wide-
range, fast-responding, neutron flux measuring system
free of short-life vacuum tubes. Results of tests on the
first experimental model of the neutron-sensitive thermo-
pile output amplification were developed and tested. A pre-
liminary model of an acoustic ionization chamber was com-
pleted and tested in the Brookhaven Reactor. A study of

pulse height analysis systems was completed, and the features of a system employing photographic film for data storage demonstrated. Statistical study of the fluctuations in period-meter indications were continued, and the analysis of multi-element logarithmic devices for use in period indicating systems was started. (For previous period see NP-5186.) (D.E.B.)

7071 UCRL-4536
California. Univ., Livermore. Radiation Lab.
A FISSION FAST COUNTER USING THE GAS SCINTILLA-TION PRINCIPLE. Alfred E. Villaire and Louis F. Wouters. December 20, 1954. 7p. Contract W-7405-eng-48.

Fission fragments emitted from a uranium surface due to neutron bombardment cause excitation events in a surrounding pure argon atmosphere. The ultraviolet radiation emitted by the decay of excited states is converted to blue light by a thin polystyrene film containing 3% tetraphenyl butadiene. The light pulse resulting from each fission event is detected by a 6292 photomultiplier tube and is of such intensity that under average conditions the output pulse height is about 0.1 volt. The pulse width is 10^{-8} second or less. (auth)

7072
MAGNETISM ON OPTICAL EXCITATION OF MANGANESE-ACTIVATED ZINC SULFIDE PHOSPHORS. Keichi Oshima and Hiroshi Nagano (Univ. of Tokyo). J. Chem. Phys. **23**, 1473-5(1955) Aug.

Changes of magnetic susceptibility accompanying the optical excitation of manganese-activated zinc sulfide phosphors were measured. It was found that there was some change in susceptibility for phosphors containing manganese more than 9.0×10^{-4} g Mn/g ZnS. While there was concentration quenching for manganese emission intensity at high manganese concentration, the value of susceptibility change increased monotonically with concentration. From these results it is concluded that the non-radiative process in concentration quenching does not affect much the excitation probability and the lifetime of the excited state which is of the multiplicity giving rise to the susceptibility change. (auth)

7073
DETERMINATION OF $C^{14}O_2$ IN A G-M COUNTER. Georgette Delibrias. J. Inorg. and Nuclear Chem. **1**, 238-40(1955) June. (In French)

A method for the measurement of small amounts of CO_2 in a Geiger counter with an addition of ethyl alcohol (1 cm Hg), is described. With an electronic time constant of 10^{-3} s, one obtains plateaus of many hundred volts. The minimum activity one can detect is about 5×10^{-12} curies of C^{14} in a CO_2 volume varying from 3 to 30 cm^3 N.T.P. (auth)

7074
ON THE QUANTITATIVE RELATION BETWEEN ISOTOPIC BETA RADIATION AND ITS PHOTOGRAPHIC RESPONSE. R. K. Poddar (Inst. of Nuclear Physics, Calcutta). Indian J. Phys. **29**, 189-98(1955) Apr.

The photographic action of the continuous β spectrum as emitted by the radioisotopes has been studied. It has been deduced theoretically that the optical density, D, produced by the β particles in any photographic emulsion should approximately vary, directly as the number, Q, of the β particles striking it per unit area and inversely as the average energy, E, of the β spectrum of the isotope con-

cerned. This relation has been experimentally verified in the case of Au^{198}, I^{131}, and P^{32}, three isotopes frequently used in biophysical investigations. It has also been found that the values of the number of β particles/cm^2 necessary to produce a density of 0.6 above background in the photographic emulsion used are 2.8×10^8, 1.7×10^8 and 6.5×10^8, respectively in the case of Au^{198}, I^{131} and P^{32}. (auth)

7075
INFLUENCE OF ALTERNATING ELECTRIC FIELDS ON THE LIGHT EMISSION OF SOME PHOSPHORS. I. T. Steinberger, W. Low, and E. Alexander (Hebrew Univ., Jerusalem, Israel). Phys. Rev. **99**, 1217-22(1955) Aug. 15.

The influence of an alternating electric field on the fluorescence and phosphorescence of various ZnS and ZnS:CdS phosphors was investigated. The light pulses and the average brightness of the luminescence were measured simultaneously. The wave pattern during fluorescence consists of two different pulses per cycle. The two pulses differ in their respective amplitudes, time dependence, and shape. The pulses corresponding to positive polarity of the illuminated electrode show a similar behavior for all phosphors. The second pulse differs for the various phosphors. Voltage dependence of the amplitudes and light sums per cycle were found to be different for the two pulses. These two pulses must be due to two different processes and suggest surface effects. (auth)

7076
THEORY OF TRACKS IN NUCLEAR RESEARCH EMULSIONS. J. M. Blatt (Univ. of Sydney, Australia). Australian J. Phys. **8**, 248-72(1955) June.

The process of the formation of a visible track in a nuclear research emulsion is approximated by a simplified model which reduces it to a one-dimensional problem. Within this basic approximation, there are included many different detailed models, including all models so far proposed in the literature. The model of O'Ceallaigh fails to agree with experimental data, and so do all straightforward generalizations of that model, such as the model of Happ, Hull, and Morrish. The reason for this failure is traced to the neglect of the "graininess" of the emulsion before development. The model of Herz, which takes the extreme opposite point of view, comes much closer to fitting the data. A reasonable modification of the Herz model is given. A more detailed comparison against experiment must still be made. (auth)

MESONS

7077
TOTAL CROSS SECTION FOR INTERACTION OF NEGATIVE π MESONS WITH DEUTERIUM IN THE ENERGY INTERVAL FROM 140 TO 400 MEV. A. E. Ignatenko, A. I. Mukhin, E. B. Ozerov, and B. M. Pontecorvo (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. **103**, 209-12(1955) July 11. (In Russian)

7078
INELASTIC SCATTERING OF NEGATIVE π MESONS WITH ENERGIES OF 300 MEV ON COMPLEX NUCLEI. N. A. Mittin and E. L. Grigor'ev (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. **103**, 219-22(1955) July 11. (In Russian)

7079
ELASTIC PHOTOPRODUCTION OF π^0 MESONS IN HELIUM

AND (γ,n) REACTION ON HELIUM AT HIGH ENERGIES.
Gerard deSaussure and L. S. Osborne (Massachusetts Inst.
of Tech., Cambridge). Phys. Rev. 99, 843-8(1955) Aug. 1.

The "elastic" photoproduction of $\overline{\pi^0}$ mesons in helium
has been measured as a function of center-of-mass angle
for gamma-ray energies from 170 Mev to 340 Mev. The
total cross section shows a maximum around 270-Mev
excitation energy and the angular distribution at 300-Mev
peaks around 65° in the center-of-mass system. An attempt
has been made to interpret the results in terms of the
differential cross section for photoproduction of π^0 mesons
in hydrogen, and to obtain (from the amount of interference
of the waves emitted by the four nucleons) a value for the
"mean radius" of the alpha particle and the relative phase
of π^0 emission from photon and neutron. The photodisintegra-
tion reaction $\gamma + He^4 \rightarrow He^3 + n$ has also been investigated.
The angular distribution of the He^3 recoil nuclei is found
to be proportional to $\sin^2\theta$ excitation energies between 40
Mev and 120 Mev. (auth)

7080

MULTIPLE SCATTERING CORRECTIONS IN $\pi^{\pm}$ DEUTERON
SCATTERING. S. D. Drell and L. Verlet (Massachusetts
Inst. of Tech., Cambridge). Phys. Rev. 99, 849-56(1955)
Aug. 1.

Multiple-scattering corrections to the impulse approxima-
tion are calculated for the scattering of $\pi^{\pm}$ mesons by
deuterons. These corrections are model dependent since
the scattered wave propagates off the energy shell between
the first and last scatterings whereas experimental scatter-
ing phase shifts are available only for elastic scattering.
Various assumptions are made concerning the off-the-
energy-shell behavior of the scattering amplitudes and the
double-scattering approximation is analyzed for meson
energies of 45 Mev and 169 Mev. The results are tabulated
and are found to be sensitive to the different scattering
models. The cross sections at 169 Mev were calculated
with both the Fermi and Bethe solutions for the meson-
nucleon scattering phase shifts and are in close agreement.
It thus does not seem to be feasible to use $\pi^{\pm} - D$ scattering
as a means of distinguishing between these two solutions.
(auth)

7081

PRELIMINARY DATA ON THE MEASUREMENT OF THE
$\mu^+ - \beta^+$ DECAY SPECTRUM. K. M. Crowe, R. H. Helm, and
G. W. Tautfest (Stanford Univ., Calif.). Phys. Rev. 99, 872-
4(1955) Aug. 1.

The results of a preliminary nature on the $\mu - \beta$ decay
spectrum are given. The data are consistent with a theory as
proposed by Michel with a parameter $\rho = 0.50 \pm 0.10$. The
background and systematic errors are discussed. (auth)

7082

K-SERIES X-RAYS FROM π-MESONIC ATOMS. M. Camac,
A. D. McGuire, J. B. Platt, and H. J. Schulte (Univ. of
Rochester, N. Y.). Phys. Rev. 99, 897-905(1955) Aug. 1.

The K-series x rays from the π-mesonic Be, B, C, N, and
O atoms have been studied. In each case measurements have
been made of the 2p-1s quantum energy, and of the fraction
of stopped pions which give rise to K-series x rays (the
"K-series yield"). The yields are: Be, 18.8 ± 1.7%; B,
13.6 ± 1.5%; C, 9.5 ± 1.0%; N, 4.5 ± 0.5%; O, 3.4 ± 0.4%. The
decrease in yield with increasing Z is attributed to nuclear
absorption of the pion from the 2p state. The 2p-1s quantum
energies are: Be, 43 ± 3.5 kev; B, 68 ± 3.5 kev; C, 92 ± 7.5
kev; N, 132 ± 2.5 kev; O, 163.8 ± 2.7 kev. The expected

energy in the case of oxygen, if only electromagnetic inter-
actions are important, is 176.0 kev; the difference is pre-
sumably due to a pion-nucleus interaction which is repulsive
in the 1s state. (auth)

7083

L-SERIES X-RAYS FROM π-MESONIC ATOMS. M. Camac,
M. L. Halbert, and J. B. Platt (Univ. of Rochester, N. Y.).
Phys. Rev. 99, 905-11(1955) Aug. 1.

The yields of the L-series x-ray lines from π-mesonic
atoms have been measured for fourteen elements between
Z = 6 and 26. The total yield rises from 18% at carbon to a
maximum of about 70% in the vicinity of aluminum, and then
decreases. This decrease is caused primarily by nuclear
absorption of pions from the 3d state; the 3d → 2p yield
determinations thus measure the nuclear absorption rate
from the 3d state. The low-Z drop off is predicted qualita-
tively by theoretical calculations of the meson cascade
scheme. The observed relative intensities of the different L
series emission lines are substantially independent of Z in
the range $6 \leq Z \leq 16$. The 3d → 2p transition energies are
consistent with electromagnetically predicted values within
the experimental error of 3 to 5% for $Z \leq 28$. (auth)

7084

RADIATIVE τ-MESON DECAY. R. H. Dalitz (Institute
for Advanced Study, Princeton, N. J.). Phys. Rev. 99,
915-20(1955) Aug. 1.

The characteristics of the decay process $\tau^{\pm} \rightarrow x^{\pm} +$
$\pi^+ + \pi^- + \gamma$ are considered. For a pseudoscalar τ meson,
the probability R(k), relative to the 3π-decay, for emission
of a photon of energy k Mev or greater is found to be
1.06×10^{-3} for k = 10 and 1.1×10^{-4} for k = 30. Quite
similar values are obtained for other spin values compat-
ible with the τ-meson decay data. Branching ratios for
other decay processes are briefly discussed and it is
suggested that the absence of the decay mode $\pi^{\pm} + \gamma$ or
$\pi^{\pm} + e^+ + e^-$ may provide some evidence against a nonzero
τ-meson spin. Competing decay processes involving a
neutrino are not considered. (auth)

7085

SECOND MAXIMUM IN THE NEGATIVE PION SCATTERING
CROSS SECTION. Freeman J. Dyson (Institute for Advanced
Study, Princeton, N. J.). Phys. Rev. 99, 1037(1955) Aug. 1.

An explanation of the second maximum in the negative
pion scattering cross section of protons is hypothesized. By
this hypothesis, the excess inelastic π-p scattering is con-
sidered to be a resonant elastic scattering of the incident
meson by a meson in the charge cloud around the proton.
The second meson being "loosely bound" allows both meson
to escape from the proton. (B.J.H.)

7086

OBSERVATIONS ON S PARTICLES. J. Ballam, A. L.
Hodson, and George T. Reynolds (Princeton Univ., N. J.).
Phys. Rev. 99, 1038(1955) Aug. 1.

Observations were made on six S events occurring in the
Princeton cloud chamber. Masses are given for primaries
and secondaries in these events. (B.J.H.)

7087

MASSES OF S PARTICLES. George T. Reynolds and W. A.
Aron (Princeton Univ., N. J.). Phys. Rev. 99, 1038-9(1955)

Masses of S particles have been reconsidered on the basis
of the mean excitation potential, I = 13.0 Z. (B.J.H.)

7088

GAMMA STABILITY OF K-MESONS. S. B. Treiman and

H. W. Wyld, Jr. (Princeton Univ., N. J.). Phys. Rev. 99, 1039-40(1955) Aug. 1.

The question arises as to why heavier members of the K-meson group do not decay into the lighter members by photon emission. Consideration is given to the possibility of strong coupling between two or more K mesons. Possible mechanisms are suggested which would inhibit such decay: the K mesons might have nearly identical masses, the particles both might have spin zero, or the K mesons might have very different spin. (B.J.H.)

7089

K-MESON MASS FROM A K-HYDROGEN SCATTERING EVENT. Warren W. Chupp, Gerson Goldhaber, Sulamith Goldhaber, William R. Johnson, and Joseph E. Lannutti (Univ. of California, Berkeley). Phys. Rev. 99, 1042-3(1955) Aug. 1.

A K_L^+ particle was observed from a hydrogen scattering event in a nuclear emulsion stack. The weighted mean of two independent methods gives a mass value of 973 ± 12 m/c. (B.J.H.)

7090

MESONIC DECAY OF A H_1^4 NUCLEUS. O. Haugerud and S. O. Sorensen (Univ. of Oslo, Norway). Phys. Rev. 99, 1046-7(1955) Aug. 1.

A description is given of a cosmic ray event which could be interpreted as the mesonic decay of a H_1^4 nucleus, containing a bound Λ^0 particle in place of a neutron, according to the mode $H_1^4 \rightarrow He_2^4 + \pi^- + Q(\cong 55 \text{ Mev})$. A preliminary value for the binding energy of the Λ^0 was found to be 2.2 Mev. (B.J.H.)

7091

$\pi-\mu$ DECAY WITH AN ASSOCIATED ELECTRON PAIR. W. F. Fry, J. Schneps, G. A. Snow, and M. S. Swami (Univ. of Wisconsin, Madison). Phys. Rev. 99, 1055-6(1955) Aug. 1.

A $\pi-\mu$ decay was found in a pellicle stack exposed to the Berkeley bevatron. Two minimum-ionizing tracks, produced by electrons, were observed to originate from the $\pi-\mu$ decay point. (B.J.H.)

7092

CAPTURE OF NEGATIVE K MESONS. Stanley C. Freden and Harold K. Ticho (Univ. of California, Los Angeles). Phys. Rev. 99, 1057-8(1955) Aug. 1.

Nuclear emulsions were exposed to a K^- beam of the Berkeley Bevatron. A summary of the observed K^- capture stars is given. (B.J.H.)

METEOROLOGY

7093

RADIOACTIVE FALL-OUT IN KINGSTON, CANADA. R. L. Preston and B. G. Hogg (Royal Military Coll. of Canada, Kingston, Ont.). Nature 176, 459(1955) Sept. 3.

The monitoring of the radioactive fall-out in Kingston, Ontario during the period Feb. 15 to May 28, 1955 from the nuclear tests conducted by the AEC is reported. Meteorological factors seem to outweigh the magnitude of the bombs at such a great distance from the explosion. (C.W.H.)

MOLECULAR PROPERTIES

7094   AEC-tr-2213

THERMODYNAMIC PROPERTIES OF LEAD, CHLORIDE IN THE FUSIONS $PbCl_2-LiCl$, $PbCl_2-NaCl$, $PbCl_2-KCl$, AND $PbCl_2-RbCl$. B. F. Markov, Iu. K. Delimarskii, and P. D. Panchenko. Translated from Zhur. Fiz. Khim. 28, 1987-98(1954). 26p.

The electromotive force of chemical circuits with mixed electrolytes in relation to temperature and composition have been measured. The thermodynamic properties of $PbCl_2$ in solutions with chlorides of alkali metals have been computed. From the thermodynamic properties one may conclude that: solutions which are formed by $PbCl_2$ with LiCl are almost ideal mixtures, and the components which form the solution are mixed with absorption of heat; when $PbCl_2$ passes into solution consisting of $PbCl_2$ and NaCl, the screening of the Pb^{++} ion probably becomes intensified, that is, the degree of dissociation of $PbCl_2$ into ions decreases; the thermodynamic properties of $PbCl_2$ in solutions with KCl and RbCl can be explained only if one admits that there also exist in the fusions, between components, compounds which have been established by thermal analysis. The free energy of reaction of $PbCl_2$ with chlorides of alkali metals have been determined, giving for LiCl + 100 cal/gr mol; NaCl-3100 cal/gr mol; KCl-6200 cal/gr mol. and PbCl-9000 cal/gr mol. (auth)

NEUTRONS

7095   ANL-5396

Argonne National Lab., Lemont, Ill.
THERMAL NEUTRON ν FOR Pu^{241}. Arthur H. Jaffey, Carl T. Hibdon, and Ruth Sjoblom. Mar. 1955. 21p. Contract W-31-109-eng-38.

The number of neutrons per fission, ν, of Pu^{241} has been measured at thermal energies relative to Pu^{239}, U^{235} and U^{233}. The measurement yielded for the product of ν and the fission cross-section: $\sigma_F \nu = 3200 \pm 60$ barn neutrons/fission. Using the recent value $\sigma_F = 1100 \pm 30$ b, we calculate $\nu = 2.91 \pm 0.10$ neutrons/fission. (auth)

7096   BNL-325

[Nuclear Cross Sections Advisory Group, AEC].
NEUTRON CROSS SECTIONS. Donald J. Hughes and John A. Harvey [Brookhaven Neutron Cross Section Compilation Group]. July 1, 1955. Addendum: HEAVY ELEMENT CROSS SECTIONS PRESENTED AT GENEVA, AUGUST 1955. July 15, 1955. 334p.

A compilation of all published and available unpublished data on neutron cross sections is presented. Tables of thermal cross sections and resonance parameters, cross section curves, and angular distribution curves are included. Curves of heavy element cross section data presented at Geneva in August, 1955 are contained in an addendum. Where possible "best values" for the cross sections are given, along with estimated errors, rather than a complete list of all measured values. The present compilation constitutes the second edition of AECU-2040, but declassified material that appeared in the classified compilation BNL-250 is also included. (M.P.G.)

7097

SIZE DISTRIBUTION OF NEUTRON WIDTHS. D. J. Hughes and J. A. Harvey (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 99, 1032-3(1955) Aug. 1.

The reduced neutron widths relative to the average value for each nuclide were plotted against the number of resonances in a given energy range with widths larger than a given value, and the resultant curve is given. At large

widths the data fit on exponential distribution, while at small widths, other distributions give a better fit to the data. (B.J.H.)

NUCLEAR PHYSICS

7098 UCRL-4507
California. Univ., Livermore. Radiation Lab.
ELASTIC SCATTERING OF COCKCROFT-WALTON-PRODUCED 14-MEV PROTONS. Carlton D. Schrader. April 18, 1955. 13p. Contract W-7405-eng-48.

An angular distribution curve resulting from the elastic scattering of 14-Mev protons by a V foil is presented, together with a description of the auxiliary equipment installed on a Cockcroft-Walton accelerator in order to use the $D(He^3, p)He^4$ reaction as a source of such protons. (auth)

7099
NUCLEAR HYPERFINE STRUCTURE IN THE PARA-MAGNETIC RESONANCE ABSORPTION OF TRIARY-LAMINIUM PERCHLORATES. O. R. Gilliam and Robert I. Walter (Univ. of Connecticut, Storrs) and V. W. Cohen (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 23, 1540(1955) Aug.

Hyperfine splitting which has been observed in the micro-wave paramagnetic resonances of dilute liquid solutions of a series of free radical triarylaminium perchlorates has been attributed to interaction of the unpaired electron moment with the N^{14} nuclear magnetic moment. These observations support the evidence for pyramidal configurations in these free radicals. (C.W.H.)

7100
FERMI'S STATISTICAL THEORY OF MULTIPLE PION PRODUCTION. K. K. Singh (Delhi Univ., India). Indian J. Phys. 29, 199-204(1955) Apr.

The probability for emission of N pions in a nucleon-nucleon collision is calculated on Fermi's model by applying relativistic classical thermodynamics to the 'pion gas'. Relative probabilities for various numbers of pions produced in a nucleon-nucleus collision are computed. (auth)

7101
REPORT FROM GENEVA. PHYSICS. Nucleonics 13, No. 9, 72-7(1955) Sept.

Information from some of the physics papers presented at Geneva is summarized. The papers included reports on neutron cross sections, fission, nuclear models, reactor materials cross sections, data on fissionable elements, and advances in nuclear instrumentation and techniques. (M.P.G.)

7102
NUCLEAR FORCES [MEETING HELD AT THE SYMPOSIUM ON NUCLEAR MODELS AND NUCLEAR FORCES, AMSTERDAM, NOV. 1, 1954]. H. J. Groenewold. Ned. Tijdschr. Natuurk. 20, 285-306(1954) Dec. (In Dutch)

7103
PROGRESS IN NUCLEAR PHYSICS. VOLUME 4. O. R. Frisch, ed. New York, Pergamon Press, 1955. 379p.

This volume presents an account of progress in some of the more important fields of nuclear study. Emphasis is focused on the development of new techniques or new insights which led to more advanced development. A section on transuranic chemistry is included. (D.E.B.)

NUCLEAR PROPERTIES

7104 AECU-3069
Michigan. Univ., Ann Arbor.
DECAY SCHEME OF In^{107}. Wayne A. Gassatt, Jr. and W. Wayne Meinke. [1955]. 13p. [Project 7. Contract AT(11-1-)-70].

The gamma radiations of In^{107} have been investigated with a scintillation spectrometer. The In^{107} was produced in a cyclotron by a (d,n) reaction on electromagnetically enriched Cd^{106}. Beta-gamma and $\gamma-\gamma$ coincidence experiments showed, in addition to the annihilation radiation, only one γ ray of 0.22 Mev associated with the 2.2 Mev positron. (auth)

7105 ISC-567
Ames Lab., Ames, Iowa.
HIGH SPECIFIC RADIOACTIVITIES OF OSMIUM FROM PHOTONUCLEAR REACTIONS. R. F. Mitchell and D. S. Martin. Jan. 28, 1955. 40p. Contract W-7405-eng-82.

The 70-Mev bremsstrahlung irradiations of Os produced a 6-hr Os activity, $Os^{191,191m}$, Re^{190}(1 hr) Re^{186} and Re^{188}. Thin Os samples were electroplated which allowed a windowless counter determination of absolute disintegration rates. By this method the relative yields of Os^{191}/Os^{191m} were found to be 0.25 ± 0.1. A relative yield, $Os^{192}(\gamma,n) Os^{191m}/Cl^{34}(\gamma,n)Cl^{34}$, of 40 was obtained. The 70-Mev bremsstrahlung irradiations of Ir yielded $Os^{191,191}$ and a 4-hr Os activity. Also produced were $Ir^{190,190m}$ (3 hrs and 12 d) and a relatively high yield of 19-hr Ir^{194}, which indicated the presence of a significant neutron flux in the vicinity of the Iowa State College synchrotron donut. A 6-hr Os daughter formed from a 12-d Ir parent was also noted. In irradiations of the compound $(NH_4)OsCl_6$, a Szilard-Chalmers effect was observed. When the target compound was subjected to a HNO_3 oxidation, 40 to 60% of the Os activity distilled with the first few milligrams of OsO_4. Enrichments as high as 40 were obtainable. Only a small fraction of activity was initially collected in an OsO_4 separation so the enrichment depended upon the rate of oxidation of the recoil atoms by HNO_3, and it was enhanced by the presence of ammonium ion. (auth)

7106 ISC-632
Ames Lab., Ames, Iowa.
NOTE ON HYPERFRAGMENTS. J. T. Jones, Jr. and J. K. Knipp. Aug. 8, 1955. 6p. Contract W-7405-eng-82.

Consideration is given to the stability of hyperfragments; $_\Lambda N^3$, $_\Lambda H^3$, $_\Lambda He^3$, $_\Lambda H^4$, $_\Lambda He^4$, $_\Lambda H^5$, $_\Lambda He^5$, $_\Lambda Li^5$. (D.E.B.)

7107 UCRL-2789
California. Univ., Berkeley. Radiation Lab.
CHARGED PARTICLES FROM BERYLLIUM BOMBARDED BY 31.3-MEV PROTONS (thesis). Reinald G. Finke. Nov. 17, 1954. 50p. Contract W-7405-eng-48.

The range spectrum of charged particles resulting from the bombardment of a thin Be foil by 31.3-Mev protons has been measured at several angles. In addition to previously reported energy levels in Be^9 at 2.4, 6.8 and 11.3 Mev, evidence for new levels at 5.0, 7.9, 19.9, and 21.7 Mev was obtained. The angular distribution of each of the inelastic proton groups has been analyzed on the basis of the Austern-Butler-McManus theory. In most cases this gave unambiguous answers for the angular momentum change for the reaction, assuming a reasonable nuclear radius. For the two cases in which Be^9 was left in the 19.9 and

21.7-Mev excited states, a rather large nuclear radius was required to give a good fit. The elastic proton angular distribution is in good agreement with that given by the Born approximation. Deuteron groups corresponding to the Be^8 ground state and first excited state were also identified. Good agreement for the angular distribution of the ground-state deuterons is found with Butler theory modified according to the proposal of Daitch and French. The group leaving Be^8 in its 3.0-Mev level is peaked forward and diminishes in cross section with increasing angle much less rapidly than any Butler prediction. (auth)

7108 AEC-tr-2212

THERMODYNAMIC PROPERTIES OF MAGNESIUM CHLORIDE IN ALLOYS OF $MgCl_2-LiCl$, $MgCl_2-NaCl$, $MgCl_2-KCl$ AND $MgCl_2-RbCl$. B. F. Markov, Iu. K. Delimarskii, and I. D. Panchenko. Translated from Zhur. Fiz. Khim. 29, 51-61(1955). 23p.

The electromotive force values were measured for chemical circuits with mixed electrolytes of the type $Mg/MgCl_2(x_1) + LiCl(1-x_1)/Cl_2$, as a function of temperature and composition of the following binary liquid systems: $MgCl_2-LiCl$, $MgCl_2-NaCl$, $MgCl_2-KCl$ and $MgCl_2-RbCl$. The thermodynamic properties of $MgCl_2$ in solution with chlorides of alkali metals were computed. Magnesium chloride with lithium chloride gives solutions which are close to ideal mixtures. Up to 20 mol % $MgCl_2$ the change of partial isobar potential of $MgCl_2$ is somewhat less than that computed for ideal mixtures; the partial entropy of $MgCl_2$ noticeably exceeds the ideal entropy; solutions are formed with absorption of heat. The thermodynamic properties of $MgCl_2$ in solutions with KCl and RbCl reflect a deep reaction between the components leading to the formation of compounds which can be separated out in a solid state. The solutions are formed with liberation of heat; the partial entropy is higher than the ideal. (auth)

7109

ON THE EXISTENCE OF A DIFFERENCE IN THE RETENTION OF THE NUCLEAR ISOMERS OF $_{35}Br^{80}$ FOLLOWING RADIATIVE CAPTURE OF NEUTRONS. P. C. Capron and L. J. Gilly (Univ. of Louvain, Belgium). J. chim. phys. 52, 505-9(1955) June. (In French)

The retention, or the fraction of radioactive Br bound to the organic molecule, of the two Br^{80} isomers in dilute liquids has been studied following the idea that if a difference exists in the ratio of activities for a purified and a non-purified liquid, it is implied that a difference exists in the retention, no matter what the absolute value may be. Experimental procedures are described in detail and resultant data are tabulated. In no instance does there seem to be any great difference in retention. (B.J.H.)

7110

ACTIVATION CURVE OF CHLORINE BY THE REACTION $Cl^{35}(\gamma,n)Cl^{34}$ NEAR THE THRESHOLD, WITH THE HELP OF A 22 MEV BETATRON. Robert Basile, Claude Schuhl, and Wilfrid Sebaoun. Compt. rend. 241, 387-9(1955) July 25. (In French)

Study of the activation curve of $Cl^{35}(\gamma,n)Cl^{34}$ shows breaks at 13.13 ± 0.07 Mev, 13.51 ± 0.07 Mev, 13.72 ± 0.07 Mev, 13.89 ± 0.07 Mev, and 14.10 ± 0.07. The value of the threshold of the reaction studied, 12.79 ± 0.07 Mev, permits calculation of the mass of Cl^{34}, 33.984781 ± 0.000133 amu, and finding the maximum energy of the β^+ spectrum of Cl^{34}, 4.57 ± 0.16 Mev. (tr-auth)

7111

THE HALF-LIFE OF THE 145 KEV LEVEL OF 141 PRASE-

ODYMIUM. H. De Waard and T. R. Gerholm. Physica 21, 599-600(1955) July. (In English)

The half life $T_{1/2} = (19 \pm 2) \times 10^{-10}$ sec was found for the 145-kev level of Pr^{141} from delayed coincidence measurements between β rays leading from the ground state of Ce^{141} to this level and conversion electrons de-exciting it. (auth)

7112

THE HALF-LIFE OF THE 163 KEV EXCITED STATE IN 139 LANTHANUM. T. R. Gerholm and H. De Waard. Physica 21, 601-2(1955) July. (In English)

A half life of $(15 \pm 1) \times 10^{-10}$ sec was found for the 163-kev level in La^{139}, excited in the β decay of Ba^{139} with the aid of a delayed coincidence instrument. (auth)

7113

THE MASS DIFFERENCE $^{41}A-^{41}K$. J. C. Kluyver and C. Van der Leun. Physica 21, 604(1955) July. (In English)

An accurate measurement of the γ energy from A^{41} prepared by Ra-Be irradiation of A^{40} was made. From this measurement the mass difference, $A^{41}-K^{41}$, was determined to be 2.543 ± 0.011 Mev. (D.E.B.)

7114

NEUTRONS EMITTED IN THE DEUTERON BOMBARDMENT OF CARBON. J. R. Bird (Univ. of Melbourne, Australia). Australian J. Phys. 8, 314-18(1955) June.

Results of a study of the $C^{13}(d,n)N^{14}$ reaction by natural C bombardment with 0.92 Mev deuterons are reported. Peak energies and angular distribution are graphed and discussed. (D.E.B.)

7115

THE HALF-LIFE OF YTTRIUM-90. E. V. Marathe (National Chemical Lab. of India, Poona). J. Sci. Ind. Research (India) 14B, 354-5(1955) July.

A new half life determination of 64.8 h for Y^{90} is discussed. Y^{90} was separated from parent Sr^{90} and counted with an end-window G-M tube for 14 half lives. (D.E.B.)

7116

NUCLEAR SPIN AND HYPERFINE STRUCTURE OF RADIOACTIVE SILVER, $^{111}_{47}Ag$. G. K. Woodgate and R. W. Hellwarth (Clarendon Lab., Oxford, England). Nature 176, 395-6(1955) Aug. 27.

An atomic beam magnetic resonance apparatus has been constructed, and the nuclear spin and hyperfine structure separation of the $^2S_{1/2}$ ground state of Ag^{111}, of half-life 7·5d, have been measured. Also a new value of g_J for silver has been derived from the experimental results. (auth)

7117

PERTURBED GAMMA-GAMMA DIRECTIONAL CORRELATION IN Cd^{114}. Scott C. Daubin and Donald R. Hamilton (Princeton Univ., N. J.). Phys. Rev. 99, 683-5(1955) Aug. 1.

The directional correlation of the $\overline{722}$-556 kev gamma-gamma cascade in Cd^{114} following K-capture in In^{114} has been observed as a function of physical and chemical state of the source. Dry $InCl_3$ and frozen solutions thereof are consistent in giving an attenuation factor 0.77 ± 0.08 in the anisotropy. The lifetime of the intermediate state is found to be $\leq 2.3 \times 10^{-10}$ sec. Assuming that the perturbing interaction is electric and making a crude estimate of an upper limit in the electric field gradient at the nucleus, one obtains a quadrupole moment $|Q| \geq 0.4 \times 10^{-24}$ cm^2 for the intermediate state of the cascade. (auth)

7118

ANGULAR CORRELATION OF THE GAMMA RAYS OF Ba^{134}.

M. G. Stewart, R. P. Scharenberg, and M. L. Wiedenbeck (Univ. of Michigan, Ann Arbor). Phys. Rev. 99, 691-4 (1955) Aug. 1.

The angular correlations have been measured between the following pairs of gamma rays from Ba^{134}: 605 kev-797 kev, 1368 kev-605 kev, and 570 kev-605 kev. These measurements indicate that the spins of the states associated with these gamma rays are 4, 4, 2, 0. The 605, 797, and 1368-kev gamma rays are pure quadrupole, while the 570-kev gamma ray is a mixture of 94% quadrupole and 6% dipole. (auth)

7119

INTERMEDIATE COUPLING ON ODD-ODD NUCLEI. R. Adkins and J. G. Brennan (Catholic Univ. of America, Washington, D. C.). Phys. Rev. 99, 706-8(1955) Aug. 1.

An intermediate-coupling model is applied to the structure of Li^6 and N^{14}. A ground-state wave function is selected which reproduces the observed ground-state moment data. A two-body potential, with spin-orbit and tensor forces included, is sought which will have the proper wave function as its lowest state and which will reproduce the observed level splitting of the lower excited states of the nucleus. The usual variational method is used, the potential is assumed to have a Yukawa radial dependence, and the wave functions are assumed to have an harmonic oscillator radial dependence. Only the p-shell nucleons are included. This procedure leads to a consistent, but not unique, result for lithium requiring a strong tensor force for satisfactory solutions. When the additional requirement of the near vanishing of the $C^{14} - N^{14}$ beta-decay element is imposed, and the procedure repeated for the nitrogen nucleus, the results are much less satisfactory. Very large and physically unmeaningful values of the potential parameters appear to be needed to obtain agreement with experimental data. (auth)

7120

MASSES OF LIGHT NUCLEI. A METHOD FOR CORRECTING A TABLE OF MASSES FOR NEW DATA. J. E. Drummond (Dept. of Scientific and Industrial Research, Wellington, New Zealand). Phys. Rev. 99, 709-10(1955) Aug. 1.

A formula is derived for correcting a set of least-squares solutions for new data. Two examples are given to show how this method can be easily applied to correct the author's own table of masses. (auth)

7121

GAMMA RAYS FROM THE DEUTERON BOMBARDMENT OF Be^9, B^{10}, N^{14}, AND F^{19}. R. D. Bent, T. W. Bonner, J. H. McCrary, W. A. Ranken, and R. F. Sippel (Rice Inst., Houston, Tex.). Phys. Rev. 99, 710-18(1955) Aug. 1.

A magnetic lens pair spectrometer has been used to study the radiations produced by the bombardment of certain light nuclei with deuterons from a Van de Graaff accelerator. Gamma rays from the bombardment of Be^9 with 2.5-Mev deuterons were observed at 6.00 ± 0.06, 5.10 ± 0.1, and 4.52 ± 0.1 Mev. At 3.85-Mev bombarding energy no lines were observed between 6.5 and 8.0 Mev with an intensity as great as 5% of that of the 6.0-Mev line. Gamma rays from the bombardment of B^{10} with 2.0-Mev deuterons were observed at 8.93 ± 0.04, 8.57 ± 0.04, 7.30 ± 0.03, 6.75 ± 0.03, 6.50 ± 0.03, 5.03 ± 0.03, 4.73 ± 0.03, and 4.49 ± 0.05 Mev. Gamma rays from the bombardment of N^{14} with 4.0-Mev deuterons were observed at 10.73 ± 0.08, 10.04 ± 0.04, 9.13 ± 0.06, 8.33 ± 0.04, 7.31 ± 0.04, 6.81 ± 0.04, 6.33 ± 0.05,

6.12 ± 0.06, and 5.26 ± 0.04 Mev. Gamma rays from the bombardment of F^{19} with 3.6-Mev deuterons were observed at 11.51 ± 0.2, 10.61 ± 0.1, 9.97 ± 0.1, and 9.34 ± 0.1 Mev. All the energies of gamma rays given above are corrected for Doppler shifts. A comparison is made for some of the reactions of the relative (d,p) and (d,n) cross sections. (auth)

7122

(p,pn) AND (p,2n) CROSS SECTIONS IN MEDIUM WEIGHT ELEMENTS. Bernard L. Cohen and Eugene Newman (Oak Ridge National Lab., Tenn.). Phys. Rev. 99, 718-23(1955) Aug. 1.

The quantity F_p/F_n, the ratio of probabilities for proton and neutron emission from nuclear reactions in the statistical region, is determined from measurements of (p,pn) and (p,2n) cross sections induced by 21.5-Mev protons bombarding nuclei of masses 48 to 71. The results are then compared with determinations of F_p/F_n from reactions induced by lower-energy protons and 14-Mev neutrons. Both the absolute values of F_p/F_n and their variation with bombarding energy are very difficult to explain by usual nuclear reaction theories. (auth)

7123

(p,pn) + (p,2n) AND (p,2p) CROSS SECTIONS IN MEDIUM WEIGHT ELEMENTS. B. L. Cohen, E. Newman, and T. H. Handley (Oak Ridge National Lab., Tenn.). Phys. Rev. 99, 723-7(1955) Aug. 1.

Several (p,pn) + (p,2n) and (p,2p) cross sections of nuclei of mass 19 to 69 were measured with 21.5-Mev incident protons. For all elements with mass less than 55 and for Ni^{58}, the (p,pn) + (p,2n) cross section is very much less than the total reaction cross section. Detailed analysis of the data indicates that this is largely due to competition from (p,2p) reactions. The conclusion from the previous paper that the ratio of probabilities for proton and neutron emission is much larger than expected seems to be confirmed and extended to lighter nuclei. (auth)

7124

TOTAL CROSS SECTIONS FOR HIGH-ENERGY NEUTRONS. Vaughn Culler and R. W. Waniek (Harvard Univ., Cambridge, Mass.). Phys. Rev. 99, 740-8(1955) Aug. 1. (cf. NSA 8-5695)

The total cross sections for high-energy neutrons have been determined for 12 elements (H, D, C, O, Al, Si, Cl, Ti, Fe, Cu, Hg, and Pb) for several points in the range between 60 and 110 Mev. The good-geometry attenuation experiment was conducted in the neutron beam produced by the bombardment of a beryllium target by the internal proton beam of the Harvard 95-in. synchrocyclotron. The angular and energy resolution permitted by the use of scintillation counter telescope techniques is discussed. Results are analyzed by using the optical model of the nucleus. (auth)

7125

DETERMINATION OF THE STRENGTH FUNCTION OF NUCLEAR ENERGY LEVELS. S. E. Darden (Univ. of Wisconsin, Madison). Phys. Rev. 99, 748-51(1955) Aug. 1.

An investigation of the average reduced neutron width to spacing ratio, or strength function, $\langle \gamma_0^2 \rangle / \overline{D}$, of nuclear energy levels has been carried out as a function of atomic weight and neutron energy. The experiment was performed by measuring deviations from exponential attenuation of a beam of neutrons passing through samples of various elements. Deviations from exponential attenuation were observed by comparing

transmissions of thin samples for neutron beams filtered through thick samples with transmissions of thin samples for unfiltered beams. (auth)

7126

NEW ISOTOPE MANGANESE-53. Joseph R. Wilkinson and Raymond K. Sheline (Florida State Univ., Tallahassee). Phys. Rev. 99, 752-4(1955) Aug. 1.

Mn^{53} has been produced by the nuclear reaction $Cr^{53}(p,n)Mn^{53}$ in the bombardment of enriched Cr^{53} for a period of 8 hours with 9.5-Mev protons. Measurements of the decay and absorption data indicate that this nuclide is an orbital electron capturing activity without gamma rays or positrons. With the assumption that the cross section for the reactions $Cr^{53}(p,n)Mn^{53}$ and $Cr^{54}(p,n)Mn^{54}$ are the same, it is possible to calculate an approximate half life of 140 years for this nuclide. These data together with those from previous measurements on the energy levels of Cr^{53} indicate that Mn^{53} probably decays from an $F_{5/2}$ ground state to a $p_{3/2}$ Cr^{53} ground state in an l-forbidden transition with a relatively high log ft value. (auth)

7127

LONG-LIVED ISOMER OF Al^{26}. T. H. Handley and W. S. Lyon (Oak Ridge National Lab., Tenn.). Phys. Rev. 99, 755-6(1955) Aug. 1.

Long-lived Al^{26} has been chemically purified from aluminum targets used in the 86-in. cyclotron. The main decay observed is through a 1.30 ± 0.15 Mev positron in coincidence with a 1.82-Mev gamma ray. In addition, gamma rays of 0.717 Mev and 2.91 Mev have been found. (auth)

7128

METASTABLE STATES OF Re^{180}, Ir^{191}, Au^{193}, Pb^{201}, AND Pb^{203}. Vera Kistiakowsky Fischer (Univ. of California, Berkeley and Columbia Univ., New York). Phys. Rev. 99, 764-70(1955) Aug. 1.

Ten elements of atomic number between 60 and 82 have been bombarded with 31.5-Mev protons and examined for activities with half-lives between 0.5 and 200 seconds. None were observed in Sm, Ho, Tm, Lu, and Ta. Those produced in W, Ir, Pt, Au, and Tl were investigated with scintillation and proportional counters. Isotope assignments were made on the basis of excitation function studies. Observed were Re^{180m} (145 seconds), Ir^{141m} (4.9 seconds), Au^{193m} (3.9 seconds), Au^{195m} (31 seconds), Au^{197m} (7.4 seconds), Pb^{201m} (60 seconds), and Pb^{203m} (6.7 seconds). Decay schemes are proposed and some regularities are discussed. (auth)

7129

RESONANT CAPTURE OF PROTONS BY FLUORINE IN THE ENERGY RANGE 0.5 TO 2.2 MEV. S. E. Hung and K. Firth (Associated Electrical Industries Ltd., Aldermaston, Berks, England). Phys. Rev. 99, 786-8(1955) Aug. 1.

The energy of a proton beam from a pressurized electrostatic generator was measured absolutely by means of an electrostatic analyzer, and used to irradiate thin targets containing fluorine. The γ-ray yield was observed as a function of proton energy and the energies for resonant proton capture were determined to an accuracy of one part in a thousand in most cases. The width of each resonance at half-maximum yield was also measured. (auth)

7130

QUADRUPOLE MOMENTS OF Ta^{181} AND Lu^{175}. Tohru Kamei (Institute of Science and Technology, Tokyo). Phys. Rev. 99, 789-91(1955) Aug. 1.

The hyperfine structure of the spectrum of Ta I was studied by means of a hollow-cathode discharge tube and a Fabry-Pérot étalon, in order to determine the quadrupole moment of Ta^{181}. The calculation was carried out for the quadrupole coupling constants of the levels $^4F_{3/2}$, $^4P_{3/2}$, $^4F_{5/2}$, and $^4F_{9/2}$ of the configuration $5d^36s^2$, in which the three 5d-electrons are combined by an intermediate coupling. This yielded the result that $Q(Ta^{181}) = (+4.3 \pm 0.4) \times 10^{-24}$ cm^2, in which the polarization correction (due to Sternheimer) is taken into account. The value of $Q(Lu^{175})$ was calculated from the data given in the literature, and was found to be $(+5.7 \pm 0.3) \times 10^{-24}$ cm^2. (auth)

7131

ENERGY LEVELS OF As^{75}. A. W. Schardt and Joan P. Welker (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 99, 810-24(1955) Aug. 1.

The excited levels of As^{75} were investigated by studying the decay schemes of Se^{75} and Ge^{75}. Beta- and gamma-ray energies, internal conversion coefficients and relative transition intensities were measured. In addition, coincidence and gamma-gamma directional correlation experiments were performed. Se^{75} electron-captures to a level at 402 kev in As^{75}; eleven transitions of indicated energy and multipolarity follow the electron-capture process: 25, 66(M1 + E2), 81, 97(E2), 121(M1 + E2), 136(M1 + E2), 199(M1 + E2), 265(M1 + E2), 280(E2), 305, and 402(M1) kev. Ge^{75} decays by emission of negative beta groups with end-point energies of 1.19, 0.98, 0.92, 0.72, and 0.55 Mev. Subsequently, six gamma rays with the following energies are emitted: 66, 199, 265, 427, 477, and 628 kev. A level scheme for As^{75} is proposed and plausible spin and parity assignments are discussed. The evidence indicates that most of the levels of As^{75} have spin $1/2$ or $3/2$ and are not single-particle shell-model states. (auth)

7132

ELASTIC SCATTERING OF 40-MEV ALPHA PARTICLES FROM HEAVY ELEMENTS. H. E. Wegner, R. M. Eisberg, and G. Igo (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 99, 825-33(1955) Aug. 1.

Angular distributions have been measured for the elastic scattering of 40-Mev alpha particles from Ta, Au, Pb, and Th in the angular range 21° to 155°. If the ratios of the measured cross sections to the Coulomb cross section are assumed equal to 1.0 at small angles, they increase slightly with increasing angle, and in the vicinity of 30° decrease exponentially with increasing angle to values less than 0.001. These data are compared with the semiclassical, strong absorption model of Blair and with the recent model of Ford and Wheeler. (auth)

7133

PRODUCTION AND IDENTIFICATION OF LONG-LIVED TECHNETIUM ISOTOPES AT MASSES 97, 98, AND 99. G. E. Boyd, J. R. Sites, Q. V. Larson, and C. R. Baldock (Oak Ridge National Lab., Tenn.). Phys. Rev. 99, 1030-1(1955) Aug. 1.

A search was made for a short-lived Tc^{98} isotope produced by 14-Mev deuteron bombardment of enriched Mo^{98} and by radiation of TcO_2 with x rays. Attempts to find this short half life were unsuccessful, and it was concluded that the half life of Tc^{98} was either very long or was nearly identical to another Tc activity. Further experiments were made on Mo metal bombarded with protons, and results show that Tc^{98} exists and is long-lived. Weighable quantities of three long-lived Tc isotopes were produced, and Tc^{95}, Tc^{97},

and Tc^{98} isotopes were seen on a mass spectrometer for
the first time. (B.J.H.)

7134

FINE STRUCTURE IN THE PHOTOPROTON SPECTRUM OF
OXYGEN. Sven A. E. Johansson and Bengt Forkman (Univ.
of Lund, Sweden). Phys. Rev. 99, 1031-2(1955) Aug. 1.

The photoproton spectrum of oxygen was investigated where
the maximum bremsstrahlung energy of 21 Mev was set
close to the (γ,p) threshold. The proton energy was measured
with nuclear plates, and a histogram of the energy distribu-
tion is shown. The investigation indicates that this method
gives considerable information about the levels in an energy
interval of several Mev above the (γ,p) threshold. (B.J.H.)

7135

INELASTIC POLARIZATION AND NUCLEON MOMENTUM
DISTRIBUTION. L. Marshall (Institute for Nuclear Studies,
Chicago). Phys. Rev. 99, 1033-5(1955) Aug. 1.

Inelastic p-p polarization is considered for the case of a
310-Mev proton hitting a 20-Mev proton in a 30-Mev potential
well. Barycentral momentum and energy are calculated for
each of five cases classified in terms of the resultant of the
momenta of the two particles. Results are compared to
experimental data. (B.J.H.)

7136

HYPERFINE STRUCTURE ANOMALY IN ATOMIC P-STATES.
Charles Schwartz (Massachusetts Inst. of Tech., Cambridge).
Phys. Rev. 99, 1035-6(1955) Aug. 1.

It is pointed out that as a result of electronic configuration
mixing there can, in principle, be an hfs anomaly in any
atomic state. The effect is calculated for Ga, and results
give $\Delta_{1/2} = (6.2 \pm 2.3) \times 10^{-6}$ and $\Delta_{3/2} = (-25.2 \pm 3.2) \times 10^{-6}$.
(B.J.H.)

7137

RATIO OF THE MAGNETIC MOMENTS OF THE STABLE
GALLIUM ISOTOPES. Michael Rice and R. V. Pound
(Harvard Univ., Cambridge, Mass.). Phys. Rev. 99, 1036-
7(1955) Aug. 1.

A method, using a recording rf spectrometer and a
permanent magnet, is described for obtaining the ratio of
the magnetic moments of the stable gallium isotopes.
Results give $\mu(Ga^{71})/\mu (Ga^{69}) = 1.2706242 \pm 0.0000020$.
(B.J.H.)

7138

OBSERVATIONS ON THE CHARGE AND MASS DISTRIBU-
TIONS IN NUCLEI. Osamu Miyatake and Clark Goodman
(Osaka City Univ. and Osaka Univ., Japan). Phys. Rev. 99,
1040-2(1955) Aug. 1.

Consideration is given to the possibility that certain
phenomena might result from a difference in mass distribu-
tion in the nucleus as compared to charge distribution.
Calculations and parameters are given for a possible dif-
ference of protonic core symmetry from nucleus symmetry
for various nuclides. (B.J.H.)

7139

MASS MEASUREMENT AND EXCITED STATES OF F^{21}.
Nelson Jarmie (Los Alamos Scientific Lab., N. Mex.).
Phys. Rev. 99, 1043-4(1955) Aug. 1.

It has been determined that F^{21} is heavy particle stable,
has a mass of 21.005703 ± 0.000025 amu, and has excited
states at 0.33, 1.11, 1.84, and 2.16 Mev. (B.J.H.)

7140

ELASTIC SCATTERING OF 48.2-MEV ALPHA PARTICLES.

Robert E. Ellis and Larry Schecter (Univ. of California,
Berkeley). Phys. Rev. 99, 1044-5(1955) Aug. 1.

The angular distributions of 48.2-Mev alpha particles
from the Berkeley cyclotron, elastically scattered from Ag
and Au, were investigated in detail for angles between 7°
and 135° in the lab system. Striking features in the distri-
butions are the departure from Coulomb scattering above 25
and the structure of the silver curve between 20 and 60°.
(B.J.H.)

7141

LIFETIME OF THE 279-KEV EXCITED STATE OF Tl^{203}.
H. de Waard (Univ. of Upsala, Sweden). Phys. Rev. 99,
1045-6(1955) Aug. 1.

A half life of $(1.2 \pm 0.3) \times 10^{-10}$ sec was found for the
279-kev level of Tl^{203}. The experimental technique is
described, and results are compared to theoretical results.
(B.J.H.)

7142

PHENOMENOLOGICAL EVIDENCE FOR POLARIZATION
OF 310-MEV PROTONS BY ELASTIC SCATTERING IN G5
EMULSION. Jerome I. Friedman (Institute for Nuclear
Studies, Chicago). Phys. Rev. 99, 1047-8(1955) Aug. 1.

A 64% polarized beam of 310-Mev protons from the
University of Chicago synchrocyclotron was scattered in
600-μ G5 nuclear emulsion. The scattering asymmetry is
shown as a function of lab. scattering angle. The experi-
ment gives phenomenological evidence for a high polariza-
tion due to elastic scattering. (B.J.H.)

7143

NEW ELEMENTS EINSTEINIUM AND FERMIUM, ATOMIC
NUMBERS 99 AND 100. A. Ghiorso, S. G. Thompson, G. H.
Higgins, and G. T. Seaborg (Univ. of California, Berkeley)
and M. H. Studier, P. R. Fields, S. M. Fried, H. Diamond,
J. F. Mech, G. L. Pyle, J. R. Huizenga, A. Hirsch, and W.
M. Manning (Argonne National Lab., Lemont, Ill.). Phys.
Rev. 99, 1048-9(1955) Aug. 1.

The results of experiments leading to the discovery of
elements 99 and 100 are described. (B.J.H.)

7144

EXPERIMENTAL CHECKS OF THE STATISTICAL THEORY
OF NUCLEAR REACTIONS. Louis Rosen and Leona
Stewart (Los Alamos Scientific Lab., N. Mex.). Phys. Rev.
99, 1052-3(1955) Aug. 1.

In order to test the validity of the compound nucleus and
the statistical model concepts, an experiment was designed
to measure the distribution in energy and angle of the
neutrons resulting from 14-Mev neutron reactions with
various elements. (B.J.H.)

7145

SHELL EFFECT ON PHOTONUCLEAR REACTIONS. J.
Goldemberg and J. Leite Lopes. Phys. Rev. 99, 1053-
5(1955) Aug. 1.

The shell structure of nuclei in the energy region of
the photonuclear effect is reviewed. (B.J.H.)

7146

NEUTRON AND PROTON DISTRIBUTIONS IN HEAVY
NUCLEI. R. G. P. Voss and R. Wilson (Clarendon Lab.,
Oxford, England). Phys. Rev. 99, 1056-7(1955) Aug. 1.

The suggestion that the neutrons in a nucleus may have
a larger spatial extension than the protons is tested by analy-
sis of the inealstic cross sections of heavy nuclides for
134-Mev protons and 140-Mev neutrons. (B.J.H.)

NUCLEAR REACTORS

7147 AECD-3667
Westinghouse Electric Corp. Atomic Energy Div.,
 Pittsburgh.
THEORY OF HOMOGENEOUS CONTROL OF A CYLINDRI-
CAL REACTOR. H. L. Garabedian. Sept. 20, 1950.
Decl. with deletions June 1, 1954. 77p. Contract AT-11-
1-GEN-14.

This paper is concerned specifically with the possibility,
from a theoretical point of view, of controlling a cylindri-
cal reactor with the aid of a large number of tubes of small
diameter, containing mercury, which are symmetrically
and uniformly distributed about the axis of the reactor.
Techniques are developed which are indispensable to de-
sign studies of a reactor with a system of homogeneous
control of the type described. The exposition on perturba-
tion methods contained in this paper is applicable to a wide
variety of reactor problems. (auth)

7148 AERE-RP/R-1604
Gt. Brit. Atomic Energy Research Establishment,
 Harwell, Berks, England.
THE DISTRIBUTION OF GAMMA-RAYS AND NEUTRONS
IN THE CONTROL FACE SHIELD OF B. E. P. O. J. R.
Harrison, A. M. Mills, and D. Bendell. Feb. 18, 1955.
18p. (SWP/P20)

Measurements of neutron and γ-ray fluxes in the con-
trol face shield of BEPO have been made. The measure-
ments extend over the entire thickness of the shield
(6'6" Barytes concrete), and cover the range of 10^7 in γ-
ray and thermal neutron intensities. It is shown that 43"
of concrete would have been sufficient for maximum
permissible levels for all radiations to have been ob-
tained. (auth)

7149 AERE-T/M-123
Gt. Brit. Atomic Energy Research Establishment,
 Harwell, Berks, England.
DIFFUSION IN A CYLINDRICAL REACTOR WITH ALL
ROUND REFLECTOR. A. Hassitt. Apr. 1955. 13p.

One group diffusion theory in a cylindrical reactor with
all-round reflector is considered. The advantages of using
relaxation methods are described. A finite difference equa-
tion, correct to order h^4, is found, which describes the be-
havior of the neutron distribution at an interface. A method
of subdividing meshes in a cylindrical geometry is given.
Higher difference corrections for a cylindrical geometry
are discussed, and it is shown how they improve the
accuracy of the answer. Results are given for a small
homogeneous reactor with heavy water reflector. The
accuracy of the relaxation solution is better than $\frac{1}{2}\%$. The
usual approximate methods for setting upper and lower
limits to the diffusion length are discussed, and it is shown
that they may be in error by 5%. (auth)

7150 ORNL-1871
Oak Ridge National Lab., Tenn.
REACTIVITY MEASUREMENTS WITH THE BULK SHIELD-
ING REACTOR: CONTROL ROD CALIBRATIONS; BEAM
HOLE COEFFICIENTS; PARTIAL REFLECTOR COEFFI-
CIENTS. E. B. Johnson, F. C. Maienschein, K. M. Henry,
R. G. Cochran, and J. D. Flynn. Sept. 16, 1955. 34p.
Contract W-7405-eng-26.

A series of experiments designed to yield information on
reactivity changes due to the presence of beam holes and
partial reflectors adjacent to a swimming pool type re-
serach reactor were performed at the Bulk Shielding
Facility. The beam holes consisted of $4\frac{1}{4}$ to $17\frac{3}{4}$-in. diam.
cylindrical ducts that varied in length from 12 to $47\frac{3}{4}$ in.;
the ducts were filled with either air or borated water.
Reactivity changes caused by placing the ducts against the
fuel of the Bulk Shielding Reactor or against a beryllium
oxide reflector of the BSR were determined. Similar deter-
minations were made for three partial reflectors: a $\frac{1}{4}$
in.-thick boral sheet against the reflector of Loading 32;
a 1 ft-thick graphite slab against the reflector of Loading
32; and a $1\frac{1}{8}$ in.-thick lead slab against the fuel of Loading
22A. Since the most practical method available for measur-
ing the change in reactivity of a reactor is by means of
calibrated control rods, safety and regulating rod calibra-
tions were made for the pertinent reactor loadings. Further
studies were made of the effectiveness of these same rods
in other reactor loadings. (auth)

7151 ORNL-1891
Oak Ridge National Lab., Tenn.
ATTENUATION BY WATER OF RADIATIONS FROM A
SWIMMING POOL TYPE REACTOR. F. C. Maienschein,
G. M. Estabrook, J. D. Flynn, E. B. Johnson, and K. M.
Henry. Sept. 19, 1955. 16p. Contract W-7405-eng-26.

The water attenuation of the γ-ray dose rate and thermal-
neutron flux from the Bulk Shielding Reactor was measured
out to distances of 770 and 470 cm, respectively. Beyond a
distance of 200 cm from the reactor, the slopes of plots of
the two measurements are similar; this results from the
fact that essentially all neutrons beyond 200 cm are
photoneutrons produced by γ rays in the deuterium occur-
ring naturally in the pool water. With the photoneutrons
subtracted, the true thermal-neutron attenuation curve is
exponential with a relaxation length that varies between
6 and 9 cm over a reduction of 10^{10}. From these measure-
ments it was determined that for 1-megawatt operation the
thermal-neutron leakage flux at the reactor surface (the
reactor was loaded with 28 fuel elements containing a total
of 3.6 kg of U^{235}, and was water-reflected) was 1.1×10^{13}
neutrons/(cm^2.sec); the γ-ray dose rate at the reactor
surface was 8×10^7 r/hr. (auth)

7152 ORNL-1925
Oak Ridge National Lab., Tenn.
A MACHINE MULTIGROUP CALCULATION. THE EYE-
WASH PROGRAM FOR UNIVAC. J. H. Alexander and
N. D. Given. Sept. 15, 1955. 64p. Contract W-7405-eng-
26.

A detailed description is given of the multigroup program
on Univac for reactor calculations. The reactor is assumed
to be a series of concentric spherical shells of homogen-
eous composition. The output has been designed to give a
summary of the input, the source distribution, the total
fissions in all groups, the absorptions in all regions in all
groups, and the escapes from all regions in all groups. The
averaged cross sections and final neutron flux are optional
in the output. Equations, tables, operating instructions,
flow charts, and storage assignments are presented.
(M.P.G.)

7153
REPORT FROM GENEVA. REACTORS. Nucleonics 13,
No. 9, 40-53(1955) Sept.

Design features and operating experience with power
reactors are summarized. Diagrams and descriptions of
Russia's Atomic Power Station (APS-1), the boiling-water
power reactor experiments (Borax-1, -2, and -3), and the

Experimental Breeder Reactor (EBR-1) are presented. Design features of power reactors under construction or planned are described. The reactors include the Pressurized Water Reactor, England's Calder Hall reactors, Scotland's Dounreay Reactor, the Homogeneous Reactor Test, the Sodium Reactor Experiment, Canada's Nuclear Power Demonstration, Norway's boiling heavy-water reactor, and the fast-neutron breeder being developed by Atomic Power Development Associates. A description is given of 4 Russian research reactors. Performance and design factors that should be considered by those choosing a research reactor and the characteristics of the principle research-reactor types are summarized. (M.P.G.)

7154

REPORT FROM GENEVA. REACTOR FUELS. Nucleonics 13, No. 9, 54-61(1955) Sept.

Reactor fuel metallurgy is briefly discussed, including methods of preparing U and Th metal, design considerations and data on fuel systems, and characteristics of slurry fuels. Radiation damage in reactor fuels is described and illustrated. Fabrication of plate-type elements is described. Fuel-separation processes are summarized, and solvent-extraction plant design and plant safety considerations are discussed. (M.P.G.)

7155

REPORT FROM GENEVA. REACTOR MATERIALS. Nucleonics 13, No. 9, 64-71(1955) Sept.

The production of heavy water, beryllium production and fabrication, and corrosion of zirconium and aluminum alloys are discussed. A summary is presented of radiation damage to reactor materials including metals, graphite, and water. (M.P.G.)

7156

A CRITERION FOR CALCULATING A HEAVY WATER HETEROGENEOUS REACTOR. S. Gallone. Energia nucleare (Milan) 2, 434-7(1955) Aug. 15. (In Italian)

A method similar to that of Atkinson and Murray for optimizing the multiplication factors of heterogeneous reactors has been applied to the determination of "optimum" lattice parameters in a natural uranium—heavy water reactor. (auth)

7157

THE DYNAMICS OF REFLECTED THERMAL REACTORS. II. A. Ascari and L. Orsoni. Energia nucleare (Milan) 2, 438-53(1955) Aug. 15. (In Italian)

The effective multiplication factor for a reflected thermal reactor, using the Rumsey method, was evaluated with one- and two-group theory. An example of numerical calculation of the dynamical parameters involved is then given for a cylindrical reactor, radially reflected. (auth)

NUCLEAR TRANSFORMATION

7158

EXCITATION STUDIES OF REACTIONS OCCURRING IN THE PROTON BOMBARDMENT OF B^{10}. J. W. G. Wignall (Univ. of Melbourne, Australia). Australian J. Phys. 8, 310-14(1955) June.

Investigation of the excitation functions for the reactions $B^{10}(p,\gamma)C^{11}$ and $B^{10}(p,\alpha)Be^{7}$ for proton energies up to 775 kev is reported. The yield of C^{11} nuclei formed in proton bombardment of a thick boron-containing target was measured as a function of proton energy. Detection was

by means of the C^{11} decay to B^{11} with the emission of 0.98-Mev positrons. The yield of Be^{7} was studied simultaneously as a function of proton energy by means of the 0.478-Mev γ emission from the electron capture decay of Li^{7}. (D.E.B.)

7159

BREAKUP OF DEUTERONS ON H, T, He^{3}, AND He^{4}. R. L. Henkel, J. E. Perry, Jr., and R. K. Smith (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 99, 1050-2(1955) Aug. 1.

Several cases of possible deuteron breakup, on H, T, He^{3}, and He^{4}, were studied. Disintegration thresholds are tabulated along with an indication of the presence of low energy neutrons. Angular distributions are also shown. (B.J.H.)

PARTICLE ACCELERATORS

7160   AERE-GP/R-1190

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A HIGH CURRENT PROTON SOURCE. P. C. Thonemann and E. R. Harrison. Jan. 25, 1955. 18p.

Proton currents approaching 20 ma at 10 kv can be produced from a moderately simple form of ion source in which the beam divergence is sufficiently small to be focused by an electrostatic lens. The increased gas flow requires high pumping speeds to maintain suitably low pressures below the ion source. (auth)

7161   AERE-T/M-125

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

NON-LINEAR EQUATIONS OF MOTION IN THE SYN-CHROTRON. M. Bell. June 1955. 14p.

The Hamiltonian approach to the equations of motion is developed. The formulation is such that the equations are obtained at once with the azimuthal angle θ rather than the time t as independent variable. The method is applied to obtain the second order equations of betatron oscillation for an azimuthally homogeneous sector. (auth)

7162   CERN-PS/CS-10

European Council for Nuclear Research, Geneva.

A NUCLEAR RESONANCE CONTROLLED RF GENERATOR. I. FIRST EXPERIMENTAL RESULTS WITH A TYPE B GENERATOR. Ch. Schmelzer and W. Schnell. June 18, 1953. 4p.

Results of experimentation with a type B nuclear res-onance controlled generator are discussed. The Bloch head, electronic system, and scanning mechanism are described. Continued work with this type generator is indicated. (D.E.B.)

7163   CERN-PS/CS-13

European Council for Nuclear Research, Geneva.

ON THE FREQUENCY GENERATED BY A SPIN-CONTROLLED OSCILLATOR. Ch. Schmelzer. Aug. 14, 1953. 4p.

The frequency generated by a spin-controlled oscillator is not equal to the resonance frequency of the spins pre-cessing under the influence of the magnetic field, but deviates due to the phase shift in the amplifying channel. A method is given for determining how the frequency error thus introduced depends on the frequency variation. (D.E.B.)

7164   CERN-PS/KJ-29

[European Organization for Nuclear Research, Geneva.
  Proton Synchrotron Group].

THE "DEBUNCHER": A DEVICE FOR REDUCING THE
ENERGY SPREAD OF A LINAC. K. Johnsen. July 1955.
12p.

To minimize the loss of particles in a synchrotron, the
energy spread of the protons leaving a linear accelerator
should be reduced before the particles enter the synchro-
tron. A single-gap "debuncher" to reduce energy spread
consists of a certain length of drift space and an r-f
gap with suitably adjusted phase and amplitude. An analysis
of the debuncher is presented, including the effects of drift
space, r-f gap, errors in phase and voltage on r-f gap,
and a numerical example. (M.P.G.)

7165   CERN-PS/RH-8

[European Organization for Nuclear Research, Geneva.
  Proton Synchrotron Group].

RELATIONS BETWEEN SURVEY AND STACKING OF
MAGNETS AND STATISTICAL DISTRIBUTION OF F-TYPE
PERTURBATIONS. R. Hagedorn. July 1955. 50p.

The effect of magnet misalignments on particle motion
in a proton synchrotron has been analyzed theoretically.
Assuming that the statistical distribution of magnet
misalignments is known, the mean square of a single
Fourier amplitude of beam perturbations, the distribution
function for all Fourier amplitudes, and the expectation
value of the closed orbit peak amplitude can be calculated.
The dependence of the misalignment distribution function
on the magnet stacking process is shown. (M.P.G.)

7166   ISC-630

Ames Lab., Ames, Iowa.

REMANENT MAGNETISM IN TOROIDS. Peter Hall and
S. Legvold. Aug. 8, 1955. 21p. Contract W-7405-eng-82.

The Brookhaven Laboratories have reported that the
remanent magnetism in the Cosmotron magnet decreases
with increasing pulse height, and increasing pulse length
(BNL-1447). A group at Iowa State College has attempted
to duplicate these effects with the simple geometry of a
virtually complete toroid. It was found in this case that
B_{rem} is independent of the pulse length, rises and ap-
proaches a constant value as the pulse height is increased.
These results confirm a previous hypothesis that the un-
usual behavior of the Cosmotron remanent field is due to
the particular configuration of the copper and iron used in
that case, and is not due to inherent properties of iron.
(auth)

7167   UCRL-3045

California. Univ., Berkeley. Radiation Lab.

INFLUENCE OF IMPERFECTIONS IN THE RF SYSTEM
ON PHASE OSCILLATIONS IN THE BEVATRON. Lloyd
Smith. June 16, 1955. 16p. Contract W-7405-eng-48.

Derivations of formulas are presented for the effects
of fluctuations in the r-f system on phase oscillations in
the Bevatron. The effects of random fluctuations and of
noise are analyzed separately, but it is shown that the two
approaches lead to the same result. Graphs are presented
illustrating the magnitude of the various effects. (M.P.G.)

RADIATION ABSORPTION AND SCATTERING

7168

EFFECTS OF VARIOUS GEOMETRICAL FACTORS ON

GAMMA-RAY COUNTING. Shuichi Aiba. J. Sci. Research
Inst. (Tokyo) 49, 144-62(1955) June.

The effects of geometry of radiation sources, detectors,
and absorbers on γ counting rates have been studied ex-
perimentally and theoretically. Charts are given for quick
estimation of γ counting rates. (B.J.H.)

7169

CORRELATION OF DIFFRACTION AND TRANSMISSION
EXPERIMENTS FOR X-RAY AND NEUTRON ELASTIC
SCATTERING. D. T. Keating (Brookhaven National Lab.,
Upton, N. Y.) and J. J. Antal (OMRO, Watertown Arsenal,
Mass.). J. Appl. Phys. 26, 1041-3(1955) Aug.

The correlation of a neutron cross-section plot in the cut-
off region and a diffraction pattern has been considered.
The cross section for elastic scattering by a sample as
determined from transmission experiments has been
related to its diffraction pattern. A cross-section plot can
be transformed into a diffraction pattern by combining the
cross section and its derivative. Examples of neutron cut-
offs exhibiting strain and particle size broadening (carbonyl
iron) and exhibiting particle size broadening alone (MgO)
have been transformed. The patterns derived by the relation
show good agreement with the x-ray-diffraction patterns.
Cross-section plots are sensitive to the state of crystalline
perfection of the sample to the same degree as are diffrac-
tion patterns. Comparisons between the two should be made
by performing the transformations given in the paper. (auth)

7170

PROTON RECOILS FROM PARAFFIN RADIATORS BOM-
BARDED BY NEUTRONS. Richard B. Rhody and John I.
Hopkins (Vanderbilt Univ., Nashville, Tenn.). Radiation Re-
search 2, 523-33(1955) Aug.

A set of general equations has been derived expressing the
number of proton recoils from solid hydrogenous materials
bombarded by neutrons as a function of target thickness, re-
coil energy of proton after it leaves the target, and incident
neutron energy. The equations are useful in the design of
neutron detectors, counters, and dosimeters. An experi-
mental check of the equations was carried out, and results
are summarized in graphical form. (M.P.G.)

7171

PROTON BREMSSTRAHLUNG. S. D. Drell and Kerson
Huang (Massachusetts Inst. of Tech., Cambridge). Phys.
Rev. 99, 686-91(1955) Aug. 1.

The cross section for proton bremsstrahlung is calculated
from Sommerfeld's work and expressed as the classical
orbit result plus a first quantum correction. This correc-
tion is due to the energy loss of the proton to radiation. For
150-kev x rays emitted at 90° to a beam of 2-Mev protons
incident on a tin (Z = 50) target, this correction decreases
the classical prediction by 25 percent and serves to establish
theoretical agreement with experimental results of Mark,
McClelland, and Goodman. (auth)

7172

ATTENUATION CROSS SECTIONS FOR 860-MEV PRO-
TONS. Francis F. Chen, Christopher P. Leavitt, and
Anatole M. Shapiro (Brookhaven National Lab., Upton, N. Y.).
Phys. Rev. 99, 857-71(1955) Aug. 1.

Integral angular distributions of 860-Mev protons
scattered by Be, C, Al, Cu, Sn, and Pb nuclei have been
measured in a transmission experiment in which the half
angle subtended at the absorber by the detector was varied
from 1.5 to 20°. A counter telescope technique employing

plastic scintillation counters and a fast-coincidence circuit was used. From the cross sections measured with poor geometry it is possible to deduce the inelastic cross section for the heavy elements and, less unambiguously, also for the light elements. Agreement with 1.4-Bev neutron data from a concurrent experiment is good. Total cross sections could not be obtained for the heavy elements because of Coulomb effects, but for the light elements rough estimates could be made. The data are consistent with an interpretation in terms of the "optical" model of the nucleus with constant nuclear density. If the nucleon-nucleon cross section at this energy is taken to be 45 mb, these measurements yield a nuclear absorption constant K of 0.56×10^{13} cm^{-1} and a nuclear radius of the form R = (1.25 ± 0.02) A$^{1/3} \times 10^{-13}$ cm. (auth)

7173

ASYMMETRY IN HIGH-ENERGY p-n-p DOUBLE CHARGE-EXCHANGE SCATTERING. Hugh Bradner and Robert E. Donaldson (Univ. of California, Berkeley). Phys. Rev. 99, 890-2(1955) Aug. 1.

Asymmetries have been observed in double charge-exchange p-n-p scattering from carbon and tantalum. High-energy protons striking a first target gave charge-exchange neutrons. These neutrons were collimated and allowed to strike a second target. The final proton fluxes to the right and left were then counted. The asymmetries are zero at small scattering angles, and increase with angle up to 45° in the laboratory system. The maximum asymmetry observed was $10.4 \pm 2.1\%$ for carbon with the first and second scattering angles equal to 45° (lab). Evidence is given for a large n-p charge-exchange polarization from carbon bombarded with 170-Mev neutrons. (auth)

7174

ASYMMETRY IN p-n AND p-p SCATTERING FROM TARGETS BOMBARDED WITH 285-MEV POLARIZED PROTONS. Robert E. Donaldson and Hugh Bradner (Univ. of California, Berkeley). Phys. Rev. 99, 892-5(1955) Aug. 1.

Asymmetries in neutron and proton production have been observed in the quasi-elastic scattering of 285-Mev, $65 \pm 4\%$ polarized protons by carbon, lithium, and beryllium targets. The neutrons and protons were counted in coincidence with the associated scattered protons. The quasi-elastic neutron data are not antisymmetric about 90° cm. The proton asymmetries are much smaller than the asymmetries from a free hydrogen target. (auth)

7175

PROTON-PROTON SCATTERING IN NUCLEAR EMULSIONS AT 432 MEV. S. K. Kao and A. F. Clark (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 99, 895-6(1955) Aug. 1.

High-energy protons from the unpolarized external beam of the Carnegie Institute of Technology cyclotron were sent through Ilford G5 nuclear emulsions of the normal and 4× gelatin types. The emulsions were area-scanned for Y-shaped stars representing events of elastic collisions of the incident protons with hydrogen nuclei in the emulsions. These events were identified through angular measurements. With known densities of hydrogen atoms in the emulsions, the differential cross sections of proton-proton elastic scattering were calculated. The result is consistent with counter measurements. (auth)

7176

MULTIPLE BREMSSTRAHLUNG. Suraj N. Gupta (Purdue Univ., Lafayette, Ind.). Phys. Rev. 99, 1015-19(1955) Aug. 1.

The cross section for the multiple production of photons in bremsstrahlung at high energies is calculated, and it is shown that the probability for multiple bremsstrahlung is quite small compared with that for the ordinary bremsstrahlung even in the very high-energy region of cosmic rays. The general problem of multiple photon production is further discussed, and it appears that even at high energies the probability for multiple photon production is appreciable only in the following two cases: (1) an energetic charged particle is deflected through an angle, which is large compared with the ratio of its rest energy and its total energy; (2) an energetic charged particle is annihilated, captured, or converted into a neutral particle. (auth)

7177

RADIATIVE CORRECTION TO HIGH-ENERGY ELECTRON SCATTERING. Hiroshi Suura (Stanford Univ., Calif.). Phys. Rev. 99, 1020-8(1955) Aug. 1.

The one-photon radiative correction to the high-energy electron scattering by a nuclear field is analyzed to all orders of Born approximation for the nuclear potential. The leading term of the fractional decrease of the elastic scattering cross section is shown to be exactly the same as that given by the first Born approximation. A detailed analysis of the effect of the long Coulomb tail on the infrared divergence is made. Also, an analysis is made on the origin of the log$m$ term which appears in the radiative correction. (auth)

7178

ELASTIC SCATTERING OF 5.25-MEV PROTONS ON NICKEL AND COPPER. D. A. Bromley and N. S. Wall (Univ. of Rochester, N. Y.). Phys. Rev. 99, 1029-30(1955) Aug. 1.

The differential cross sections for the elastic scattering of 5.25-Mev protons on nickel and copper are plotted. A brief analysis of the results is given. (B.J.H.)

7179

DENSITY EFFECT IN IONIZATION ENERGY LOSS OF CHARGED PARTICLES. Jacob Neufeld and R. H. Ritchie (Oak Ridge National Lab., Tenn.). Phys. Rev. 99, 1125-8 (1955) Aug. 15.

A more rigorous justification is given for the statement made by Aage Bohr that for an incident particle of relativistic velocity, the electrostatic effect of the surrounding electrons is negligible and the main factor in the screening is due to the electromagnetic interactions which limit the impact parameter to a value c/Ω, where $\Omega = (4\pi n e^2/m)^{1/2}$ and n is the electron density in the medium. (auth)

7180

SCINTILLATION RESPONSE OF ANTHRACENE TO LOW-ENERGY PROTONS AND HELIUM IONS. E. J. Zimmerman (Univ. of Nebraska, Lincoln). Phys. Rev. 99, 1199-1203 (1955) Aug. 15.

Photomultiplier pulse amplitudes produced by light from anthracene crystals bombarded by protons and helium ions from 25 to 375 kev were measured. Both response curves (pulse height vs. energy) are nonlinear, but that for protons bends away from the energy axis while that for helium ions bends towards it. Both curves extrapolate smoothly to the origin, indicating an absence of any nonscintillating surface layer more than about 10-kev thick. Present knowledge of stopping cross sections (dE/dx) for anthracene is inadequate to permit an unambiguous determination of the specific fluorescence (dL/dx) from the observed pulse amplitudes. However, some qualitative conclusions can be drawn concerning Birks' theory of the fluorescent process. (auth)

RADIATION EFFECTS

7181

FAST NEUTRON BOMBARDMENT OF p-TYPE GERMANIUM.
J. W. Cleland, J. H. Crawford, Jr., and J. C. Pigg (Oak Ridge
National Lab., Tenn.). Phys. Rev. 99, 1170-81(1955) Aug. 15.

Extensive studies of fast neutron bombardment effects in
p-type Ge have been carried out. Analysis of the initial
conductivity behavior indicates the introduction of three
vacant states below the middle of the forbidden band: (1)
an acceptor state 0.18 ev above the valence band, (2) an
occupied (donor) state which acts as a hole trap with a depth
of ~0.07 ev, (3) a second low-lying donor which is a quite
shallow hole trap. This distribution of energy levels is con-
sistent with the Frenkel defect model of James and Lark-
Horovitz. After prolonged bombardment or room temper-
ature aging, the ionization energy of bombardment-produced
acceptors moves to lower values, a behavior which has been
attributed to a difference in annealing rate of interstitials and
vacancies. The scattering mechanism for holes in bombarded
specimens does not appear to be completely describable in
terms of ionized impurity scattering. Moreover, the tem-
perature dependence of hole mobility is quite different from
electron mobility in bombarded specimens. Extensive bom-
bardments in the range from $-165°$ to $-90°C$ are described
and complex relaxation effects observed on warming are
discussed. (auth)

7182

RADIATION INDUCED CHANGES IN THE ELECTRICAL
RESISTIVITY OF α BRASS. D. B. Rosenblatt (Frankford
Arsenal, Philadelphia) and G. J. Dienes (Brookhaven
National Lab., Upton, N. Y.). J. Appl. Phys. 26, 1044-9(1955)
Aug.

Nucleon irradiation of metallic solid solutions may lower
their resistivity by changing the degree of randomness
(tendency to order or to cluster) or by a change of elastic
moduli. Measurements of resistivity of brasses containing
10, 20, and 30% zinc have been performed at room tem-
perature, at 80°K and at 4°K. The alloys were irradiated in a
reactor at +50°C and at 80°K. It appears that the results can
be best interpreted in terms of the formation of lattice
defects upon low temperature exposure and increase of short-
range order upon irradiation at +50°C. The change of
residual resistivity is negative while the change of resistivity
due to thermal scattering is positive for the samples ir-
radiated at +50°C. The former depends upon irradiation
flux and upon annealing time in a different manner from the
latter. Short-range order appears to be produced also by
proper heat treatment. (auth)

7183

ATOMIC RADIATIONS CHANGE MATERIALS. C. Mannal,
C. A. Bruch, and R. F. Koenig (Knolls Atomic Power Lab.,
Schenectady, N. Y.). Power 99, No. 7, 94-6, 196-8 200-
2(1955) July.

The changes produced in materials by atomic radiations
are reviewed, with emphasis on the fact that reactor design
engineers must deal with radiations as an additional factor
to the more usual ones of weight, strength, hardness, etc.
(B.J.H.)

RADIOACTIVITY

7184   NRL-4583

Naval Research Lab., Washington, D. C.
A SPECTRUM OF THE GLOW FROM A RADIOACTIVE

SOURCE. Interim Report. L. F. Drummeter, Jr. and
J. A. Curcio. June 24, 1955. 8p. Project NR633-050.

A low-dispersion spectrum has been obtained of the
glow from a water solution of radioactive Ba-La. The
spectrum shows a continuum beginning at 3000 A and in-
creasing in intensity to the photographic plate cut-off at
5000 A. Superimposed on this continuum is emission
structure which has been identified as emission from N_2
and N_2^+. Above 4000 A there is a very faint structure which
is thought to be absorption mainly due to NO_2. (auth)

7185   UCRL-3104

California. Univ., Berkeley. Radiation Lab.
ELECTRON CAPTURE AND THE AUGER EFFECT IN THE
HEAVIEST ELEMENTS (thesis). Peter Rygaard Gray.
Aug. 1955. 111p. Contract W-7405-eng-48.

The Auger effect in the heaviest elements has been in-
vestigated. K Auger yields for Y, Po, and U of $0.064 \pm$
0.01, 0.058 ± 0.005, and 0.033 ± 0.010, respectively, were
obtained. The K Auger electrons of Y and Po were re-
solved into two groups, K-LL and K-LX, according as two
or one L electrons were involved. The ratios of the in-
tensities of the K-LX electrons to the K-LL electrons for
Y and Po were found to be 0.64 ± 0.05 and 0.55 ± 0.03,
respectively. A summary of measurements of K fluores-
cence yields and K Auger electron intensity ratios is given.
The nuclear decay properties of several nuclides in the
heaviest elements have been investigated. The electron
capture decay of Np^{236}, At^{211}, Po^{207}, and Em^{211} has been
studied and decay schemes have been proposed. In addi-
tion, the α spectrum of At^{209} has been observed. Log ft
values have been calculated for 18 electron-capture
nuclides in the heaviest elements whose decay schemes
are known or can be inferred from β decay. These log ft
products have been used to classify the electron-capture
transitions as to forbiddenness. A logarithmic plot of the
electron capture partial half life versus neutrino energy
has been made for both the allowed and forbidden species.
(auth)

7186   USNRDL-TR-42

Naval Radiological Defense Lab., San Francisco.
CALIBRATION OF A COBALT-60 SOURCE FOR USE IN
ANIMAL EXPOSURE STUDIES. R. L. Hoover and F. M.
Tomnovec. Mar. 10, 1955. 20p. Project NM-006-015.

The strength of an uncalibrated Co^{60} source obtained
from the Oak Ridge National Laboratory was estimated to
be 10 curies. Before animal exposure studies could be
made, the source had to be calibrated so that the radiation
dosage received by the animals could be determined. This
was accomplished by comparing the source obtained from
Oak Ridge to a Co^{60} source that had been calibrated by the
National Bureau of Standards. The instruments used in
making the comparison were a Victoreen Condenser R-
meter and a Victoreen Ion Chamber. DuPont 558 film was
used to establish the field limitations and to check the
isodose and isometric relationship. In order to check the
accuracy of the method of calibration employed, two
additional Co^{60} sources were calibrated and then sent to
the National Bureau of Standards for calibration. The
differences in the values obtained for the two sources here
and at NBS, were 0.54% and 0.47%. The error of the
method described is ±3.61% while the National Bureau of
Standards' calibration is ±3%. (auth)

7187   AEC-tr-2215

RADIOACTIVE DECAY OF La^{140}. A. A. Bashilov, B. S.

Dzhelepov, and L. S. Chervinskaya (Chervinskaia). Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 18, 88-92(1954). 7p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-4778.

7188

ON THE DISINTEGRATION OF Gd^{159}. Nadine Marty. Compt. rend. 241, 385-7(1955) July 25. (In French)

The disintegration of Gd^{159} into two β spectra is reported. β_1 has a maximum energy of 948 ± 10 kev ending in the ground state of Tb^{159}. β_2 has a maximum energy of 598 ± 8 kev, 16% intensity, followed by a very weakly converted ($\alpha_K \sim 10^{-2}$) 364-kev photon. Transition to the 56-kev level is less than 10%. (tr-auth)

7189

RADIOACTIVITY OF Gd^{159} AND Tb^{161}. Roland Barloutaud and Rene Ballini. Compt. rend. 241, 389-91(1955) July 25. (In French)

Evidence is given by coincidences for two low-intensity transitions in the radiation of Gd^{159}. Also, it has been shown that the most energetic β spectrum of Tb^{161} does not end in the ground state of Dy^{161}, but in an excited state (about 75 kev) of this nucleus. (tr-auth)

7190

EXPERIMENTAL STUDY OF THE DOUBLE β RADIO-ACTIVITY OF Cd^{116}. Jean-Francois Detoeuf and Raymond Moch. Compt. rend. 241, 393-5(1955) July 25. (In French)

A coincidence method of observing double β decay in Cd^{116} is described. Radiations from Cd^{114} and Cd^{116} were compared, and results show that in 200 hours, 109 coincidences were found from Cd^{116} and 106 from Cd^{114}. The half life for double β decay of Cd^{116}, on the basis of these results, must be $>0.6 \times 10^{17}$ years. (B.J.H.)

7191

ON THE THEORY OF ALPHA DISINTEGRATION AND THE DETERMINATION OF NUCLEAR RADII. H. A. Tolhoek and P. J. Brussaard (Univ. of Leiden, Netherlands). Physica 21, 449-70(1955) June. (In English)

Several changes are proposed in the theory of alpha disintegration, namely: a) a density distribution, characterized by two parameters, the nuclear radius, R, and the surface thickness, s, is assumed for the nucleons of the nucleus. b) the potential for the a particles is composed of the Coulomb potential and a nuclear potential well falling off gradually near the nuclear surface. A relation between the nuclear potential well and the nuclear density distribution is assumed, which contains the range of nuclear forces β and the radius of the a particle, β_a. c) the depth V_0 is assumed to be much larger than before (about 167 Mev instead of 30 Mev). d) the frequency v_a with which the a particle hits the potential barrier is assumed to be much smaller than before (smaller by a factor of about 10^5). The estimates of V_0 and v_a are based on the independent particle model of the nucleus, with a common potential well for the nucleons. Numerical calculation of the nuclear radius R for the case of Po^{214} gave a value of $r_0 \approx 1.13 \times 10^{-13}$ cm (where $R = r_0 A^{1/3}$) with the improved theory. Although the accuracy of this determination should not be overestimated, it may be concluded that no contradiction is apparent between the determination of nuclear radii from alpha decay and the newer methods using x-rays from mu-mesonic atoms or high-energy electron scattering. (auth)

7192

THE INTENSITY OF THE SOFT SECOND β-SPECTRUM IN ^{142}Pr. M. J. Sterk, R. H. Nussbaum, and H. Cerfontain. Physica 21, 541-2(1955) June. (In English)

The branching ratio of the Pr^{142} beta spectrum was remeasured, and the intensity of the low-energy branch was found to be 2.8 ± 0.4%. It was concluded that the departure from a single spectrum absorption curve of Pr^{142} due to the second β branch is negligible. (B.J.H.)

7193

RHENIUM 190. A. H. W. Aten, Jr. and G. D. De Feyfer. Physica 21, 543(1955) June. (In English)

A brief discussion of the preparation of a β-emitting rhenium isotope by n or d bombardment of Os is given. Some of the difficulties in chemical separation are also discussed. (B.J.H.)

7194

A SHORT-LIVED RUTHENIUM ISOTOPE. A. H. W. Aten, Jr. and T. De Vries-Hamerling. Physica 21, 544(1955) June. (In English)

The preparation and chemical separation of Ru^{94} produced by irradiation of Mo with He ions are briefly discussed. (B.J.H.)

7195

A GENERALIZATION OF THE BATEMAN-POISSON LAW FOR TIME CORRELATED ALPHA-EMISSION. H. Lindeman (Israel Inst. of Tech., Haifa). Physica 21, 589-95(1955) July. (In English)

A derivation is given of a probability law, which replaces the Bateman-Poisson law, in cases of time-correlated α-emission, as occurs for example for some members of the Th series. This probability law has a structure similar to the Bateman-Poisson law, but differs from it by a certain factor B which depends on the size of the counting interval and on the decay constants of the radioactive daughter substance involved in the time-correlated emission. The law is used to generalize Adams' calculations of the probability function for the α emission in the entire Th series. The theoretical results are compared with experimental data and good agreement is found. The derived law may be applied to any chain of events where similar time correlations exist. (auth)

7196

DECAY OF Bi^{207}. D. E. Alburger and A. W. Sunyar (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 99, 695-702(1955) Aug. 1.

Bi^{207} has been found to decay by electron capture accompanied by gamma rays of energies 0.569 ± 0.0015, 0.894 ± 0.007, 1.0639, 1.43 ± 0.01, and 1.771 ± 0.005 Mev having transition intensities of 100 : 0.16 : 87 : 0.16 : 8% per disintegration, respectively. K-conversion electron intensities are 1.7, 0.0039, 8.2, 0.0009, and 0.022 electrons per 100 disintegrations respectively. The 0.894, 1.43 and 1.771-Mev transitions have K-conversion coefficients of $(2.4 \pm 1) \times 10^{-2}$, $(5 \pm 2) \times 10^{-3}$ and $(2.5 \pm 0.5) \times 10^{-3}$. The first of these is in agreement with M1 radiation and the latter two with E2 or E2 + M1 radiations. Electron capture branches are 87% to the $i_{13/2}$ state at 1.633 Mev, 5 ± 2% to the 0.57-Mev first excited state and 8 ± 2% to a level at 2.35 Mev. Branching to the 2.35-Mev level proceeds only by L-capture as shown from the x-ray spectrum in coincidence with 1.78 + 0.57 Mev photopeak sum pulses. The decay energy to the 2.35-Mev level thus lies between 15 and 90 kev and the total Bi^{207} decay energy is 2.40 ± 0.04 Mev. Gamma-gamma and electron-gamma correlation experiments confirm the 1.06-

0.57 Mev cascade as $13/2 \rightarrow 5/2 \rightarrow 1/2$ while the 1.78-0.57 Mev gamma-gamma correlation is isotropic to within 5%. A spin $\geq 7/2$ for the 2.35 Mev state is supported by a cross-over intensity of $< 6 \times 10^{-5}$ per disintegration as determined with a photoneutron detector. An assignment of $f_{7/2}$ to the 2.35 Mev level is compatible with all of the data including the 1.78-0.57 Mev angular correlation, if the 1.78-Mev transition is assumed to consist of a mixture of ~94% E2 and ~6% M1. Fast-coincidence techniques have been used to show that the 0.57-Mev level has a lifetime of $< 4 \times 10^{-10}$ sec. (auth)

7197
ENERGIES OF THE RADIATIONS FROM Co^{57} AND Co^{58}. J. M. Cork, M. K. Brice, and L. C. Schmid (Univ. of Michigan, Ann Arbor). Phys. Rev. 99, 703-5(1955) Aug. 1.

Using magnetic and scintillation spectrometers, the energies of the radiations from Co^{57} and Co^{58} have been evaluated. Several gamma rays not previously reported have been observed. Co^{57} decays mainly by K capture but also to a slight extent by positron emission with an upper energy limit of about 300 kev, followed by gamma rays with energies 14.6, 29, 99.8, 122.8, 137.4, and 700 kev. Co^{58} decays by K capture and with positron emission of upper energy 485 ± 10 kev. Gamma rays with energies of 814 and 500 and possibly 1300 kev accompany the decay. (auth)

7198
DECAY OF Sc^{47}. W. S. Lyon and Bernd Kahn (Oak Ridge National Lab., Tenn.). Phys. Rev. 99, 728-30(1955) Aug. 1.

Sc^{47} was milked from $\overline{Ca^{47}}$, prepared by proton irradiation of CaO, and its radiations were studied by coincidence and gamma-ray spectrometry. Sc^{47} was found to decay with the emission of beta rays of 0.46 ± 0.02 and 0.62 ± 0.03 Mev maximum energy. 66 ± 3% of the decay is accompanied by a 0.157 ± 0.007 Mev gamma ray in coincidence with the 0.46-Mev beta rays. (auth)

7199
CASCADE GAMMA RAYS FROM $_{84}Po^{214}$(RaC'). R. E. Rowland (Argonne National Lab., Lemont, Ill.). Phys. Rev. 99, 757-9(1955) Aug. 1.

Seven gamma cascades of $_{84}Po^{214}$ have been identified by means of coincidence scintillation spectrometry: gamma rays of energy 0.77, 0.93, 1.12, 1.24, 1.38, 1.52, and 1.85 Mev appear in coincidence with the 0.607-Mev photon transition to the ground state. The existence of a weak beta transition to the 0.607-Mev level was also verified. Four other gamma rays, of energy 0.85, 1.77, 2.20, and 2.40 Mev, appear as direct transitions to the ground state. Both gamma-gamma and beta-gamma coincidences were employed to verify the suggested energy level scheme. (auth)

7200
K^{40} BRANCHING RATIO. A. McNair, R. N. Glover, and H. W. Wilson (Univ. of Glasgow, Scotland). Phys. Rev. 99, 771(1955) Aug. 1.

The ratio of γ to β transitions occurring in the decay of K^{40} has been accurately determined by two different counting methods, yielding the ratios 0.124 ± 0.002 and 0.121 ± 0.004, respectively. (auth)

7201
EVIDENCE AGAINST THE EXISTENCE OF 23-HOUR V^{53}. Raymond K. Sheline and Joseph R. Wilkinson (Florida State Univ., Tallahassee) and Bruce J. Dropesky and Theodore T. Shull (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 99, 1055(1955) Aug. 1.

Three bombardments, fast neutrons on enriched Cr^{53},

α particles on Ti^{50}, and fast neutrons on normal Cr, failed to produce any 23-hour V activity. In view of the favorable conditions for producing this activity, the results indicate that 23-hour V^{53} does not exist. (B.J.H.)

THEORETICAL PHYSICS

7202 CERN-55-11
European Organization for Nuclear Research, Geneva. A MATHEMATICAL FORMULATION OF THE GELL-MANN NEW PARTICLES MODEL. B. d'Espagnat and J. Prentki. July 15, 1955. 29p.

It is shown that an axiomatic formulation of the Gell-Mann model concerning elementary particles is possible. Different kinds of fields are formally introduced which are defined by their transformation properties in ordinary (Lorentz) space and isotopic space, the latter being three-dimensional. The fundamental assumption is that the Lagrangian for strong interactions must be invariant under rotation and reflection in isotopic space. Also postulated are the Lorentz invariance and the conservation of baryons. The most general form of the strong interactions Lagrangian that follows from these assumptions is given. From this, the constants of motion I_3 and N are deduced as well as a new constant U. The values of U turn out to be those postulated in the Gell-Mann model. Possibilities of introducing other fields are investigated. (auth)

7203
NONADIABATIC TREATMENT OF NUCLEAR FORCES. I. STATIC LIMIT. Junji Iwadare (Kyoto Univ., Japan). Progr. Theoret. Phys. (Japan) 13, 189-99(1955) Feb.

The canonical transformation is applied to the problem of nuclear forces. Here, the nucleon field as well as the meson field is quantized. One can obtain the expressions for potentials which do not contain the total energy of the system explicitly. The 2nd- and 4th- order potentials are evaluated in the Ps(ps) meson theory. The practical calculations are performed up to the order $(\mu/2M)^4$ for the one- and the two-pair terms, and up to the order $(\mu/2M)^5$ for the no-pair terms in the static limit p/M $\rightarrow$ 0. The results are in agreement with Klein's calculation. Nonstatic corrections will be treated in the forthcoming paper. (auth)

7204
THE D-WAVE CONTRIBUTION TO PION-NUCLEON SCATTERING. Taiji Yamanouchi and Nobuyuki Fukuda (Tokyo Univ. of Education). Progr. Theoret. Phys. (Japan) 13, 200-4(1955) Feb.

The d-wave phase shifts of the pion-nucleon scattering are calculated by the covariant perturbation theory, up to 4-th order in the coupling constant, adopting the symmetrical pseudoscalar meson theory with pseudoscalar coupling. It is shown that the 2nd-order calculation gives at most two degrees at 200 Mev as d-phase shifts and the 4th-order contribution can almost be neglected. This result seems to be consistent with the experimental analysis by Glicksman at 217 Mev. (auth)

7205
INVARIANT TRANSFORMATION CROSS SECTIONS OF NONPOLARIZED PARTICLES. R. Ryndin and Ya. Smorodinskii (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. 103, 69-71(1955) July 1. (In Russian; cf. NSA 8-5073 and 8-5459.)

Aspects of scattering of π mesons or nucleons by polarized and unpolarized nucleons are treated. (G.Y.)

7206

ON RENORMALIZATION GROUPS IN QUANTUM ELEC-
TRODYNAMICS. N. N. Bogolyubov and D. V. Shirkov
(Steklov Mathematics Inst.). Doklady Akad. Nauk S.S.S.R.
103, 203-6(1955) July 11. (In Russian)

7207

ENERGY EIGENVALUES FOR A SPHERICAL WELL WITH
AN EXPONENTIALLY DIFFUSE BOUNDARY. Alex E. S.
Green and Kiuck Lee (Florida State Univ., Tallahassee).
Phys. Rev. 99, 772-7(1955) Aug. 1.

The discrete energy eigenvalues of a spherical well with
an exponentially diffuse boundary are obtained to a good
approximation for a range of well parameters of interest in
nuclear physics. The method used involves replacing the
centrifugal energy in the exponentially diffuse region by an
approximate expression which leads to analytic solutions of
the wave equation. The matching of the internal and external
wave functions is then accomplished by the use of specially
prepared graphs and tables. The eigenvalues and eigenfunc-
tions are thought to be of interest in connection with studies
of the independent particle model of the nucleus. (auth)

7208

CONFIGURATION MIXING AND QUADRUPOLE MOMENTS
OF ODD NUCLEI. Hisashi Horie (Princeton Univ., N. J.)
and Akito Arima (Univ. of Tokyo). Phys. Rev. 99, 778-
85(1955) Aug. 1.

The quadrupole moments of odd nuclei are calculated
from the standpoint of configuration mixing. The calcula-
tions are based upon the simple perturbation theory. The
quadrupole moments of odd-neutron nuclei are due to the
excitation of one or more protons. The quadrupole moments
of odd-proton nuclei also contain the quadrupole moments
of the initial configuration. The agreement between the
calculated and observed values are fairly good except for
the nuclei with very large quadrupole moments. (auth)

7209

INDEPENDENT PARTICLE MODEL OF THE NUCLEUS.
I. INTERPARTICLE FORCES AND CONFIGURATION
MIXING. Carl Levinson and Kenneth W. Ford (Indiana
Univ., Bloomington). Phys. Rev. 99, 792-802(1955) Aug. 1.

A simplified method of obtaining the direct interaction
between two identical nucleons in the nuclear shell model
is given for the special case of singlet forces. Configura-
tion interaction is included in the method. A semi-empirical
analysis of simple two and three particle nuclear spectra
is outlined which enables one to determine properties of the
two-body perturbing interaction provided many body forces
are negligible and coupling to the nuclear surface is weak.
Corrections to the singlet force formalism due to triplet
central and tensor forces are discussed. Formulas are
given for magnetic dipole and quadrupole moments and
magnetic dipole transition rates for mixed three-particle
configurations. (auth)

7210

PARTICLE STATES IN SPHEROIDAL NUCLEI. Steven A.
Moszkowski (Univ. of California, Los Angeles). Phys. Rev.
99, 803-9(1955) Aug. 1.

Particle motion in a spheroidal box has been studied by
making an appropriate coordinate transformation so that the
potential appears as spherically symmetric. The effect of
the nonsphericity then appears as a change in kinetic
energy for which the perturbation matrix elements can be
evaluated. Matrix elements between states in different
major shells are small. The energy levels and wave func-

tions (defined in the transformed coordinate system) can
then be calculated by the customary techniques of matrix
diagonalization. This method was used to obtain energy
levels of a spheroidal box both without and with an additional
spin-orbit term of the magnitude suggested by nuclear shell
systematics. Corresponding results for distorted wells of
finite depths appear to be rather simply related to those for
a box. Nuclear deformations predicted by this picture are
in qualitative agreement with experimental values, and are,
in general, considerably smaller than the values implied by
a hydrodynamical model. (auth)

7211

EXCHANGE MOMENT CONTRIBUTIONS TO A MODIFIED
SHELL MODEL. A. Russek (Univ. of Buffalo, N. Y.).
Phys. Rev. 99, 834-43(1955) Aug. 1.

The longitudinal exchange contribution to the nuclear
magnetic moment that follows from a rather general modi-
fied shell model is studied. It is shown that for a heavy
nucleus whose state can be expanded as a linear combination
of certain very reasonable independent particle configura-
tions, the longitudinal exchange contribution to the magnetic
moment can be expressed, independent of the amplitudes of
these states, in terms of a correction to the orbital Landé
g-factor that appears in the single particle ordinary moment
operator. The magnitude of this correction is simply given
in terms of the fraction of the neutron-proton two-body
potential that is charge exchange and spin-independent.
Being independent of the configuration amplitudes, this re-
sult is expected to hold even if the core behaves as a liquid
drop. Calculations assuming roughly half of the nuclear
force to be charge exchange in nature reasonably account
for the deviations from the values predicted by the shell
model of the magnetic moments of those nuclei which con-
sist of a single odd nucleon outside a doubly magic core.
The exchange contributions generally improve the moment
agreement of other nuclei in the $j = l - \frac{1}{2}$ cases, but make
the agreement in the $f_{7/2}$ and $g_{9/2}$ cases poorer. (auth)

7212

ELECTROMAGNETIC PROPERTIES OF THE NUCLEON
IN A FINITE SOURCE THEORY. R. H. Capps and W. G.
Holladay (Univ. of Wisconsin, Madison). Phys. Rev. 99,
931-43(1955) Aug. 1.

Some electromagnetic properties of nucleons are investi-
gated under the assumption that the nucleon consists of a
spin one-half core particle in interaction with the pion field
through a gauge-invariant, non-relativistic, pseudoscalar,
finite source interaction. Recoil of the nucleon core is
neglected and the weak coupling approximation is used. A
method is presented for making the finite source interaction
between two particle fields gauge-invariant by introducing
filaments of current in the region of the source function.
The theoretical contributions of interaction currents to the
magnetic moments of the proton and neutron are calculated
and found to be small compared to the observed anomalous
moments and of the opposite sign. The model is used to
calculate, in the limit of zero source size, the total and
differential cross sections for scattering of gamma rays
from nucleons. The results, which are presented graphically
are found to be in accord with the conditions imposed on a
finite theory in the preceding paper. They are compared to
the results obtained by Sachs and Foldy on the basis of a
point-source theory. (auth)

7213

PION-NUCLEON SCATTERING AT HIGH ENERGIES.

A. N. Mitra (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 99, 957-65(1955) Aug. 1.

The pseudoscalar theory in the Tamm-Dancoff approximation is applied to high-energy pion-nucleon scattering with a view to explaining the observed maximum in π^--p scattering around 1 Bev as a resonant interaction. The integral equation is solved for the $D_{3/2}$ state of $T = \frac{1}{2}$ which is attractive. The various singularities in the kernel and the wave function are taken into account in a semianalytical fashion. A short derivation is given of the complex integral equation which takes the effects of meson production into account, and it is solved in an approximate manner. It is found that, contrary to the original expectation of a resonant interaction, the increase of $D_{3/2, 1/2}$ phase shift over the Born approximation is not large. Also the effects of meson production are not found to be very significant over the energy range 1 to 2 Bev. This last is contrary to the observations in this energy range. (auth)

7214
NEUTRON-ELECTRON INTERACTION. George Salzman (Univ. of Illinois, Urbana). Phys. Rev. 99, 973-9(1955) Aug. 1.

The effective neutron-electron interaction is calculated with the cut-off pseudoscalar meson theory and neglect of nucleon recoil. Values of -7.1 and -8.6 kev are obtained for the meson contribution with two different shapes for the cut-off function. The nucleon contribution is ambiguous in the cut-off theory since the shape of the core charge is undetermined. It is shown that if the no recoil theory with cutoff is interpreted to be the limit, as the nucleon mass becomes infinite, of a relativistic theory with a cutoff, then the contribution of the anomalous magnetic moment (or Foldy) term is not contained in our calculation. Since the Foldy term alone accounts for the major part of the experimental interaction, the sum of pion and nucleon charge contributions in this theory, if correct, should be at most of the order of a few hundred ev, or an order of magnitude less than the pion part. Finally, a brief calculation is made to illustrate the fact that, if spread out in a plausible way, the nucleon core charge could effect the needed cancellation. (auth)

7215
QUASI-BOUND STATES OF THE PION-NUCLEON SYSTEM IN THE LOWEST TAMM-DANCOFF APPROXIMATION. B. P. Nigam and H. P. Noyes (Univ. of Rochester, N. Y.). Phys. Rev. 99, 989-95(1955) Aug. 1.

The question is asked whether the lowest order Tamm-Dancoff equation, which agrees with the observed p-state meson-nucleon scattering for $G^2/4\pi \sim 15$, leads to a quasi-bound state of high angular momentum capable of being identified with the Λ^0 particle. Both a static potential approximation and an approximate form of the integral equation indicate that values of $G^2/4\pi$ of the order of several hundred would be required to give sufficient binding. Although the results are not quantitatively reliable, the authors feel they indicate that either the T-D approximation is inadequate for this problem or that the Λ^0 particle cannot be a quasi-bound state of the pion-nucleon system. (auth)

7216
QUANTUM EFFECTS IN THE INTERACTION BETWEEN FREE ELECTRONS AND ELECTROMAGNETIC FIELDS. P. S. Faragó (Central Research Inst. for Physics, Budapest, Hungary) and G. Marx (Physical Inst. of the Eotvos Univ., Budapest, Hungary). Phys. Rev. 99, 1063-4(1955) Aug. 15.

An electron beam shot through a transverse rf field may suffer a directional spread. If experimental conditions are suitably chosen, the directional spread may be due only to the quantum dispersion of energy exchange between free electrons and rf field. A simple collector electrode system might allow not only the detection of the directional spread of the electrons, but the presence of a quantum effect might be checked by plotting the collector current versus rf field amplitude, the plot for the quantum effect being different from those for classical effects. The results of various theoretical treatments of the effect are briefly compared, both from the point of view of their principal foundations and of the possibility of their experimental verification. (auth)

7217
VARIATIONAL CALCULATION OF ELECTRON SCATTERING BY A STATIC POTENTIAL. Lyman Mower (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 99, 1065-9 (1955) Aug. 15.

The Schwinger variational method, for the approximate determination of scattering amplitude, is tested for accuracy in the case of the elastic scattering of electrons from the static potential $V(r) = -e^2 N_0 e^{-\lambda r}/r$, by using eight different forms of trial wave functions. The results are compared by checking the closeness of fit of the associated scattering amplitude with an exact solution to the problem. In the course of the calculation, a number of expressions, of use in more complicated problems, were obtained and are here recorded. The parameter values used in the test were $a_0\lambda = \frac{8}{3}$, $k^2 = (0.72\lambda)^2$, $V_0 = 7.8$, where a_0 is the first Bohr orbit radius for hydrogen. (auth)

7218
OUTGOING AND INGOING WAVES IN FINAL STATES AND BREMSSTRAHLUNG. Haakon Olsen (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 99, 1335-6(1955) Aug. 15.

It is shown that outgoing waves may be used to describe electrons in final states and bremsstrahlung. The case considered is that of a Dirac electron in a spherical symmetric potential. (B.J.H.)

TRACER APPLICATIONS

7219
REPORT FROM GENEVA. RADIOISOTOPES. Nucleonics 13, No. 9, 78-92(1955) Sept.

Information on radioisotopes from papers presented at the Geneva conference is summarized. Many examples of tracing by radioisotopes are given. Gaging by radioisotopes and medical applications of radioisotopes are also discussed. (M.P.G.)

URANIUM AND URANIUM COMPOUNDS

7220 SEP-160
Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.
MECHANISM OF DIMENSIONAL INSTABILITY. L. L. Seigle and A. J. Opinsky. Aug. 2, 1954. Decl. May 12, 1955. 26p. Contract AT-30-1-GEN-366.

An explanation of the dimensional instability of alpha-uranium under irradiation is advanced, based upon the anisotropic diffusion of lattice imperfections to grain boundaries and free surfaces. An approximate solution of the diffusion equations for an ellipsoidal grain is obtained,

which predicts growth rate as a function of pile flux, temperature, and grain size. The calculations are applied to polycrystalline material and some comparisons made between theory and experiment which confirm the feasibility of the suggested mechanisms of dimensional instability. (auth)

7221

MEASUREMENT OF THE EFFECTIVE CAPTURE CROSS SECTION OF U^{236} FOR A SPECTRUM OF PILE NEUTRONS. Jean-Michel Auclair, Pierre Hubert, Rene Joly, and Georges Vendryes. Compt. rend. 241, 392-3(1955) July 25. (In French)

The absolute measurement of the β activity of U^{237} formed in a pile by the $U^{236}(n,\gamma)U^{237}$ reaction permits calculation of the effective average radiative capture cross section of U^{236}. The value obtained for the Saclay pile is about 24 ± 7 barns. Precision is limited principally by the uncertainty in the effective radiative capture cross section of U^{235} and in the effective activation cross section of cobalt. (tr-auth)

7222

FISSION OF U^{235} BY 14-MEV NEUTRONS: NUCLEAR CHARGE DISTRIBUTION AND YIELD FINE STRUCTURE. Arthur C. Wahl (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 99, 730-39(1955) Aug. 1.

The following results were derived from experiments in which iodine was quickly separated from irradiated uranium metal at a known time after irradiation. The fractional chain yields are based on the cumulative chain yields at iodine.

	Ratio of cumulative yields, 14-Mev/thermal neutron fission	Fractional chain yield	
		14-Mev	Thermal
I^{131}	1.48 ± 0.07	<0.08	<0.01
Te^{131m}	5.5 ± 1.5	0.35 ± 0.05	<0.05
Te^{131}	...	<0.30	<0.03
I^{132}	1.12 ± 0.02	0.16 ± 0.01	<0.01
Te^{132}	0.97 ± 0.02	...	...
I^{133}	0.81 ± 0.03	<0.40	<0.05
Te^{133m}	0.64 ± 0.15	...	...
Te^{133}	...	<0.40	<0.1
I^{134}	0.65 ± 0.02	0.43 ± 0.02	0.11 ± 0.02
I^{135}	0.69 ± 0.02	...	...

The error given is the standard deviation of the average of the experimental results; it does not include the 4% standard deviation for the ratio of 14-Mev to thermal neutron fission yields of Mo^{99} used in the calculation of the ratio of cumulative yields. The results indicate that the pronounced peak in the mass-yield curve found at mass number 134 in thermal-neutron fission is nearly washed out in 14-Mev-neutron fission. The higher independent yields of late members of the chains in 14-Mev-neutron fission indicate a shift toward stability of the most probable initial nuclear charge. This shift is about 0.7 charge unit for the chains in the mass region studied. As by-products of the work, the following half-life values were determined: I^{133}, 20.9 ± 0.3 hour; I^{132}, 2.30 ± 0.05 hour; fission precursor of I^{135}, <0.4 minute. (auth)